ELECTRICAL REVIEW

FRIDAY
28 JULY 1961

WEEKLY
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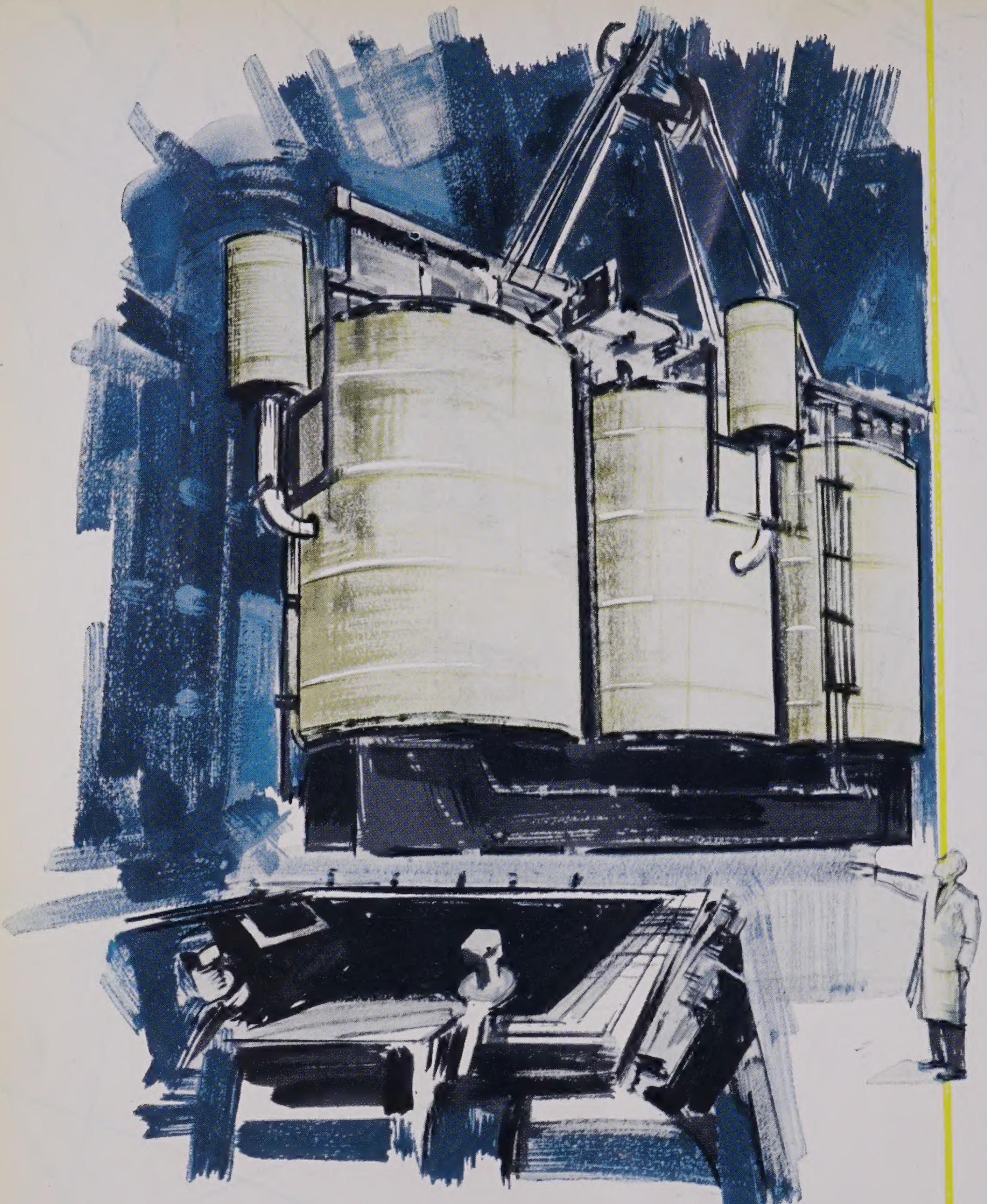
Serial Record

This is one of the simplest and most reassuring equations in the Cable Industry. It means that, for **wiring cables and flexible cords,** the AEI Cable Division can offer you three times the Eager Beaver Service which you enjoyed of yore. Their combined resources can give you three times the willingness, three times the resourcefulness and three times the knowledge. It's good to know, in the hazards of modern business life, that you can rely on something that can really stand on its own legs. And the AEI Eager Beaver Proposition can certainly do that. All six of them!

CIRCULATION COPY 1

AEI **CABLE DIVISION** Associated Electrical Industries Limited
Cable Sales Department 51/53 Hatton Garden London EC1 Tel: CHAncery 6822



The artist's impression shows the completed core and winding assembly of a 120 MVA 275/132 kV Auto transformer being lowered into the vacuum drying chamber at Fuller Electric Ltd.

The material for this core was supplied by R.T.B. and cut and assembled by Fuller Electric.

RTB Electrical Steel

LAMINATIONS of all types, in all sizes and in all grades of material.

FERROSIL hot-rolled and cold-reduced electrical sheet and strip, and hot-rolled transformer sheet.

ALPHASIL cold-reduced grain oriented transformer sheet and strip.

RTB

Richard Thomas & Baldwins Limited

Enquiries for sheet and strip to be addressed to RICHARD THOMAS & BALDWINS (SALES) LTD.,
WILDEN, STOURPORT-ON-SEVERN, WORCS.

Enquiries for laminations to be forwarded to RICHARD THOMAS & BALDWINS LTD.,
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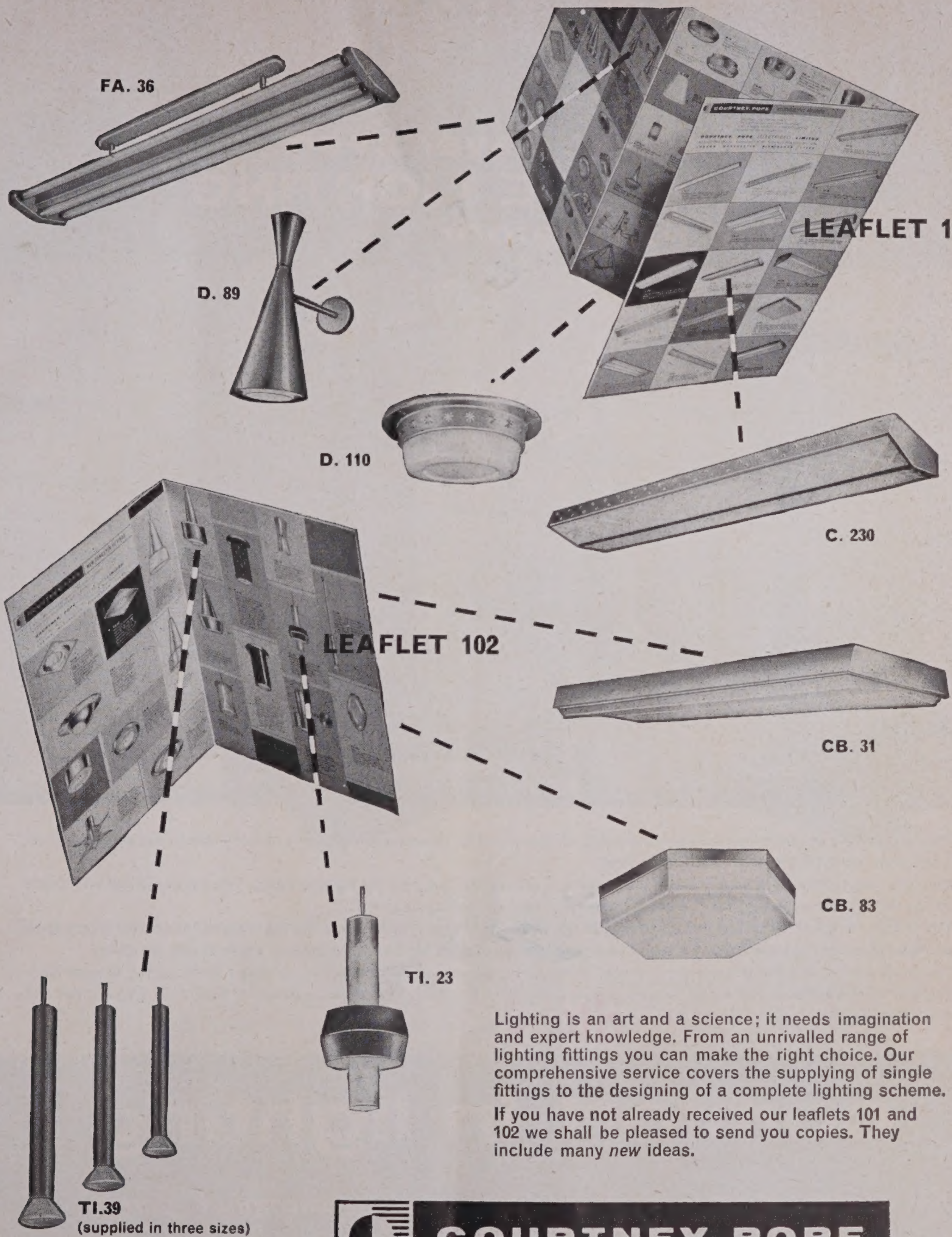

Lighting is an art and a science; it needs imagination and expert knowledge. From an unrivalled range of lighting fittings you can make the right choice. Our comprehensive service covers the supplying of single fittings to the designing of a complete lighting scheme.

If you have not already received our leaflets 101 and 102 we shall be pleased to send you copies. They include many *new* ideas.

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THE LIGHTING SPECIALISTS

COURTNEY, POPE (ELECTRICAL) LTD
AMHURST PARK WORKS · Tottenham London N.15
Telephone: STAmford Hill 1270 *(fifteen lines)*
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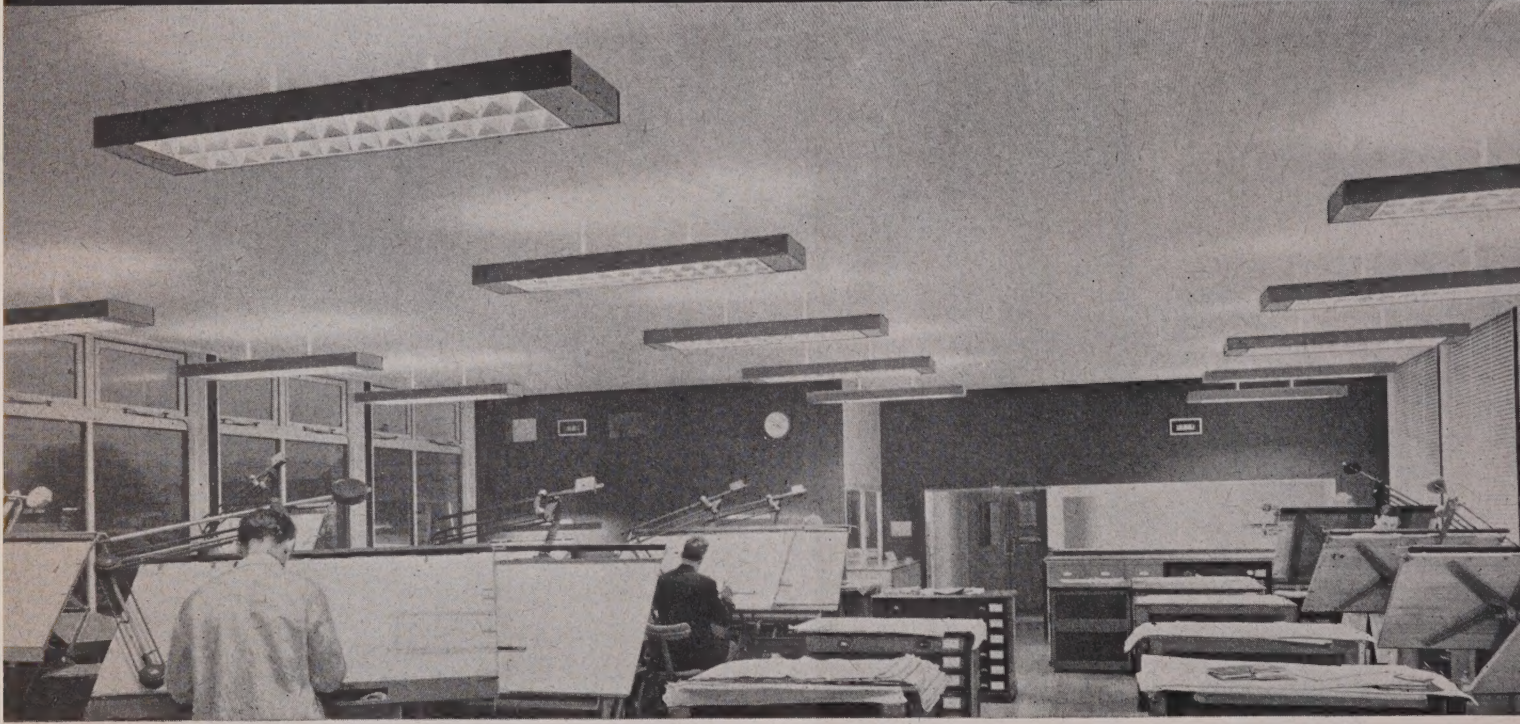
17 Wellington Street, Leeds 1 (Leeds 3-4549)

you have never seen OFFICE LIGHTING like this before . . .



Pleasant working environments with accompanying efficiency call for reasonably high levels of illumination—but such high level illumination must be free from discomfort glare.

Merely to increase the light source brightness results in excessive glare from the lighting fitting. The answer is low brightness fittings of high luminous output—"Comfort in Lighting" fittings developed by G.E.C.

The G.E.C. range of "Comfort in Lighting" fittings is the only one which meets the recommendations for every type of installation of the new Code for Good Interior Lighting issued by The Illuminating Engineering Society.

You could see lighting like this every day in *your* office, by installing G.E.C. "Comfort in Lighting". Write for the 40 page illustrated brochure F4695 or better still, ask us to send a Lighting Engineer. Our Lighting Advisory Service is entirely free and without obligation.

comfort in lighting

means high level illumination without discomfort glare.

G.E.C.

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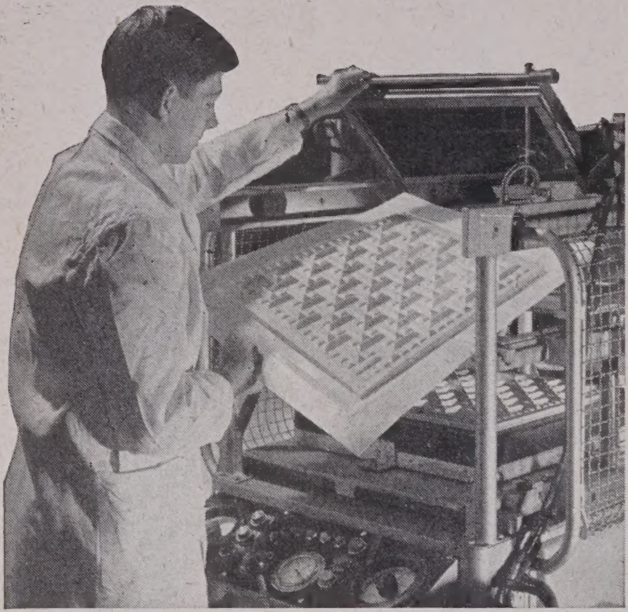
I. C. I. PLASTICS FOR MODERN LIGHTING



Vacuum forming panels in 'Flovic' vinyl copolymer sheet in the T.S. and D. Dept. Laboratories, I.C.I. Plastics Division.

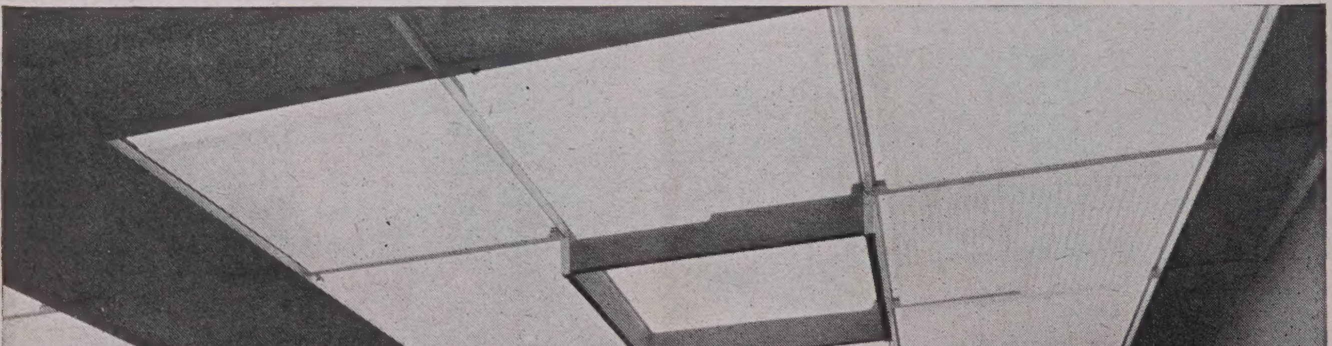
'Flovic' translucent foil for luminous ceilings

Today many showrooms and similar establishments are lighted effectively by luminous ceilings.

'Flovic' translucent foil has been specially formulated for luminous ceilings. It is tough, free from the risk of discoloration, resistant to burning and optically efficient.

'FLOVIC'

'Flovic' is the registered trade mark for the vinyl copolymer foil manufactured by I.C.I.



This shows a 'Sylvalume' lighting system made by Atlas Lighting Ltd., installed in a Service Centre of the Merseyside and North Wales Electricity Board. This system, which gives a diffused light, incorporates 3′ x 3′ dishes vacuum-formed in 'Flovic' foil. Some of the dishes have a patterned finish and others a plain finish. An octagonal type diffuser is also available in this material.

ICI IMPERIAL CHEMICAL INDUSTRIES LIMITED · LONDON S.W.1

PFL2

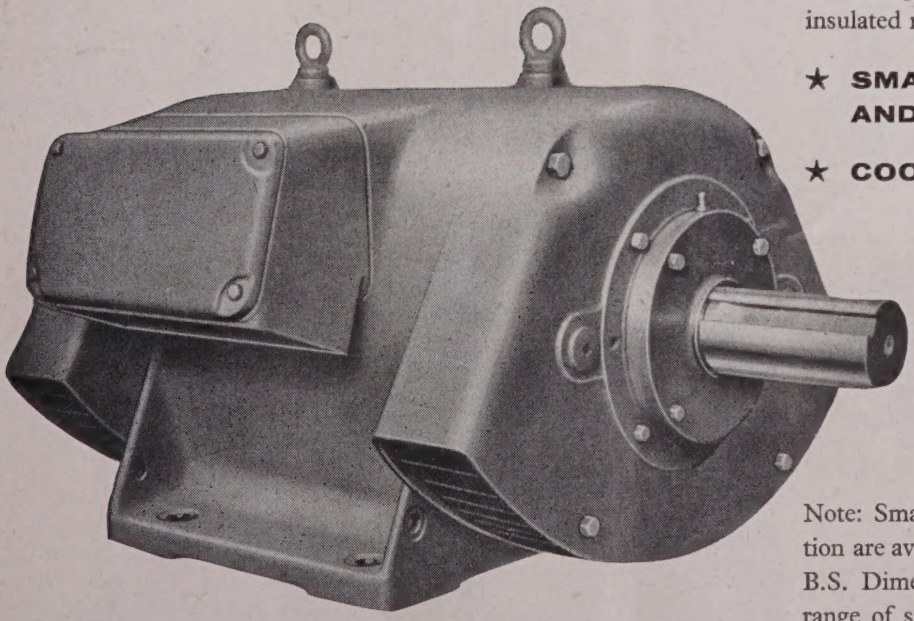
80-285 h.p. motors with Class 'E' Insulation

A new range of induction motors—
squirrel-cage, Type NC
and slip-ring, Type NW

Class 'E' insulation permits a temperature rise of 65°C in accordance with BS 2613/1957 and compared with conventional class 'A' insulated motors, these new machines have:

★ **SMALLER OVERALL SIZE AND COST** *for a given rating, with*

★ **COOL OUTER CASING**



available for early despatch

Note: Smaller motors with class 'E' insulation are available in the range 1-75 HP, with B.S. Dimensions. Also available is a wide range of suitable control gear.

for further details send for publication 3512-1

AEI

Motor and Control Gear Division
Associated Electrical Industries Limited
RUGBY AND MANCHESTER

A5533

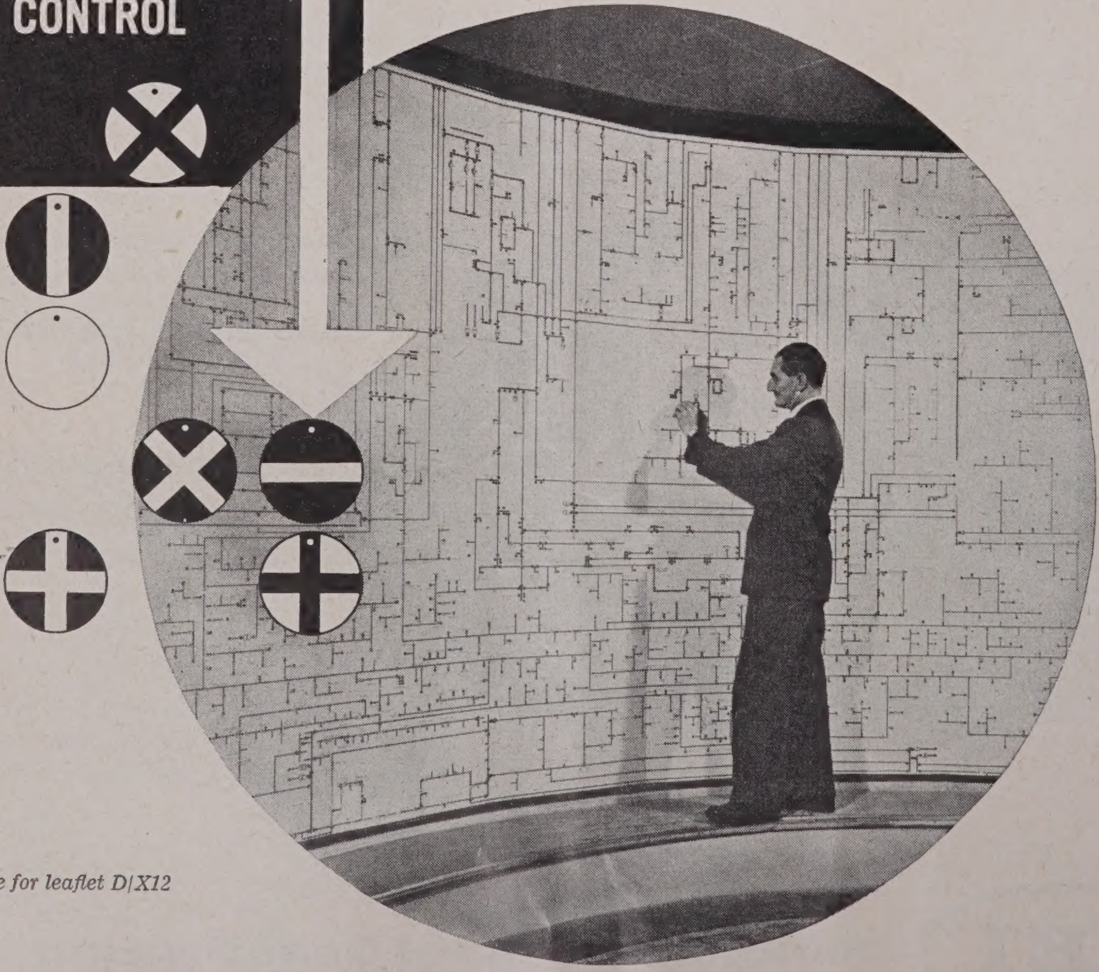
STC pin-fix diagrams

FOR

POWER NETWORK INDICATION & PROCESS CONTROL

The STC Tele-Control Pin Fix diagram meets the need for a neat, permanent and economic manually set mimic diagram for electrical distribution systems and industrial applications. It has a very good space factor, enabling a considerable amount of detail to be displayed with clarity in a small area. Simple changes, e.g., from "Close" to "Open" indications of a circuit breaker, are made without removal of symbols, whilst more extensive changes, e.g., the addition of a sub-station, are made with ease and simplicity and without the use of special tools. A full comprehensive range of symbols is available.

With this form of construction it is not necessary to replace a diagram when the size and requirements of a system change. The addition of the necessary number of panels and rearrangement of the diagram is all that is required to display the new conditions of the system. These diagrams are suitable either for a wall or floor mounting and the framework can be finished to match the existing surroundings.



Write for leaflet D/X12

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is reduced quality and output, greater depreciation, and increased accident risks, so CLEAN UP with

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Details of Sturtevant Industrial Vacuum Cleaners are given in Publication U5014/5 which will be supplied on request.

the only satisfactory means of removing dirt, dust, litter, spillage, swarf or similar refuse from all types of surfaces, machinery, containers, crevices, recesses, fabricated assemblies, etc.

Compact, mobile, low in power consumption, and available in many sizes and capacities, Sturtevant machines meet innumerable cleaning requirements throughout Industry, and give trouble-free service under all conditions.

★ *Sturtevant machines provide the cleanest, simplest, and most effective means of cleaning boiler flues.*

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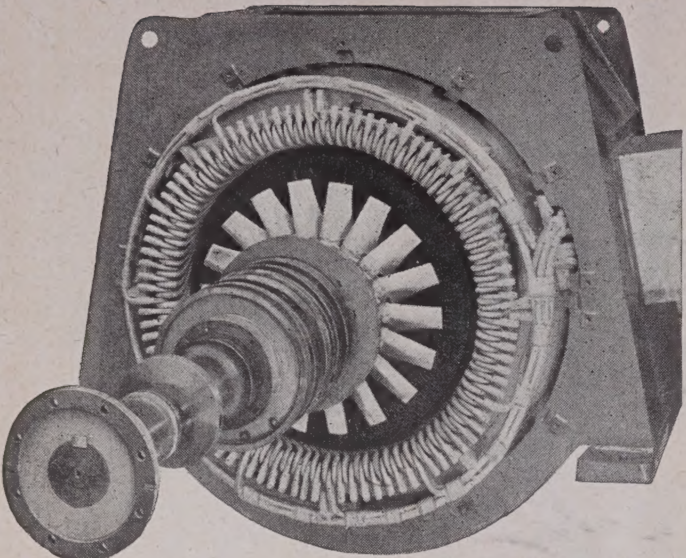
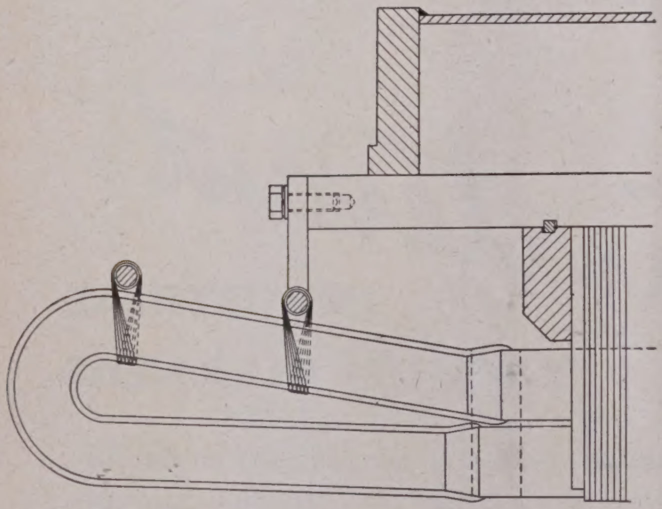
AUSTRALIA: STURTEVANT ENGINEERING CO. (AUSTRALASIA) LTD., MILLER ROAD, VILLAWOOD, N.S.W.



There comes a point in every design where the practical takes over from the theoretical. Up to this point all equipment of the same kind is—potentially at least—the same because theory is common ground. Beyond it success depends largely on experience; on having done the job many times before. It is here that the differences between motors with the same specified performance show up, and the word performance itself takes on the wider, vaguer, but essentially more realistic, meaning which includes those things—robustness, reliability, ease of maintenance—which an engineer has in mind when he thinks of a first-class job.

This thing called know-how



A very simple example of this essentially empirical approach is provided by the bracing and anchoring of the end windings of large A.C. motors. Many such machines are required to start direct-on-line or to have to deal with arduous braking duties. In these circumstances, the forces between coils are very considerable and the design of the end bracing is particularly important. It might well be thought that the windings would be most effectively braced at their outer ends, but experience has shown that this is not so. The forces are greatest about half way along the out hang and the greatest stability is achieved when a frame-anchored bracing ring is placed at this point. A further unanchored ring is fitted at the coil evolutes. It is in detail of this kind that a manufacturer's experience shows itself.

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Makers of Electric Motors of all kinds A.C. and D.C.
Generators, Cables, Switchgear, B.E.T. Transformers,
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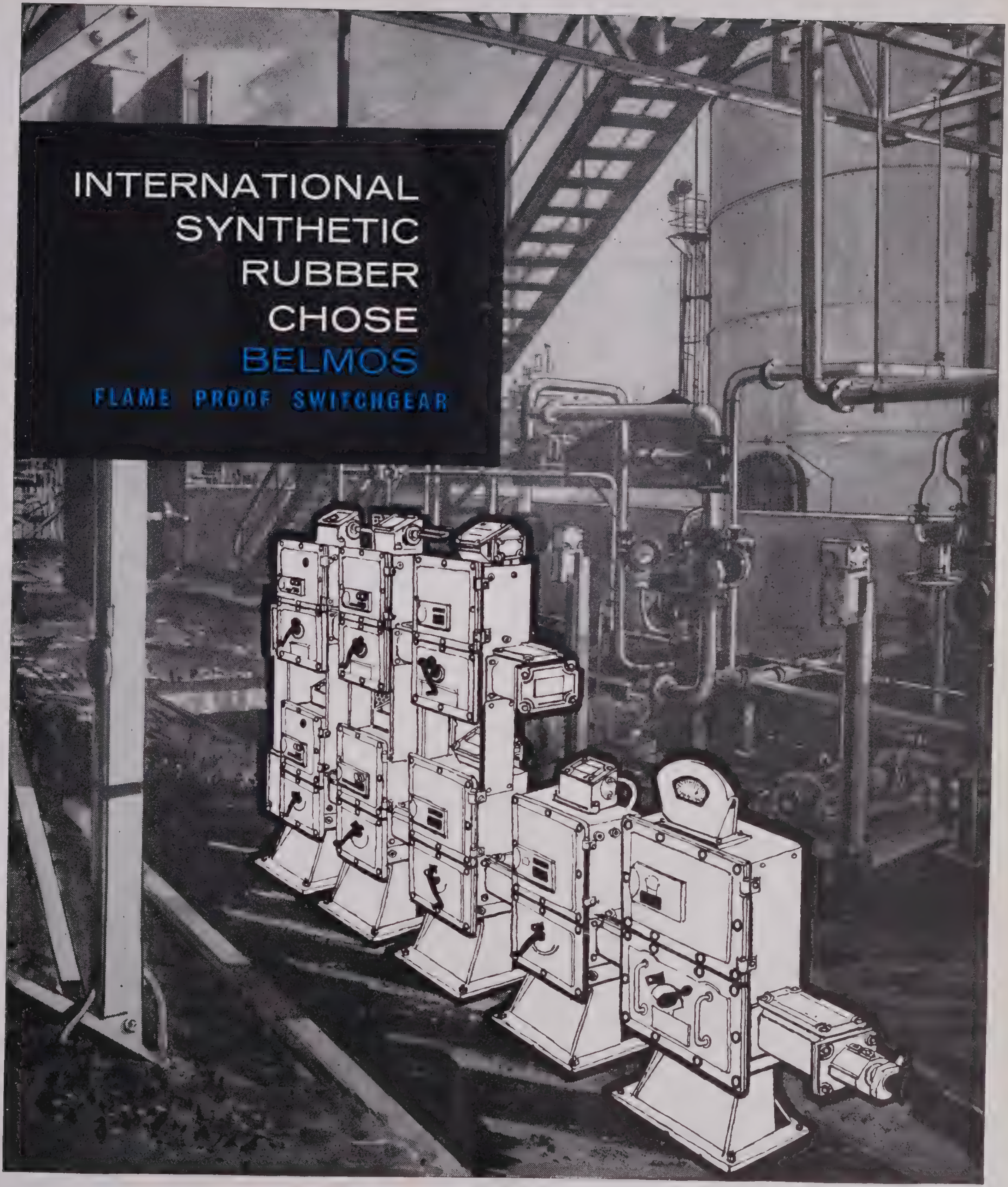

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The International Synthetic Rubber Company Limited required flameproof switchgear for their manufacturing plant at Southampton—switchgear which had to be of the utmost reliability, offering complete protection against any explosion hazard. They chose Belmos because of its reputation for safety and performance above or below ground. If you are interested in switchgear for industrial or flameproof applications Belmos would be glad to put their resources—over 40 years devoted exclusively to the design and manufacture of motor control gear—to work for *you*.

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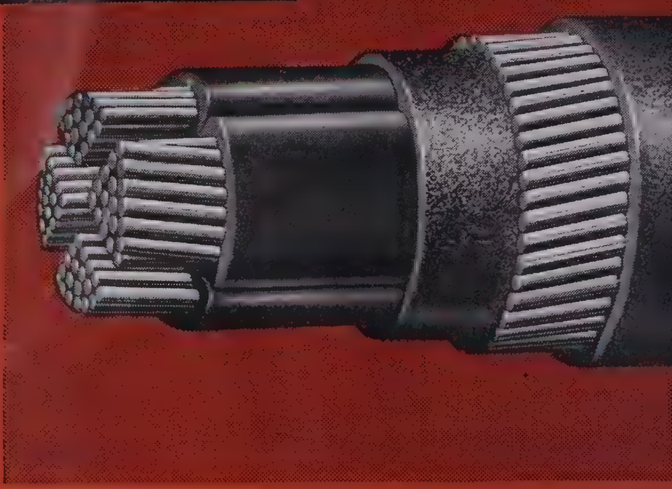

CONNOLLYS

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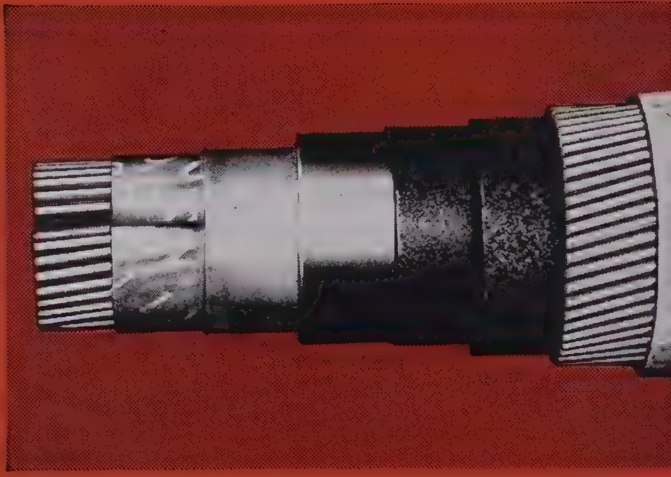
Standard range covers 1,100 volts to 11,000 volts with full range of armouring and overall protection with bituminous textiles or P.V.C.

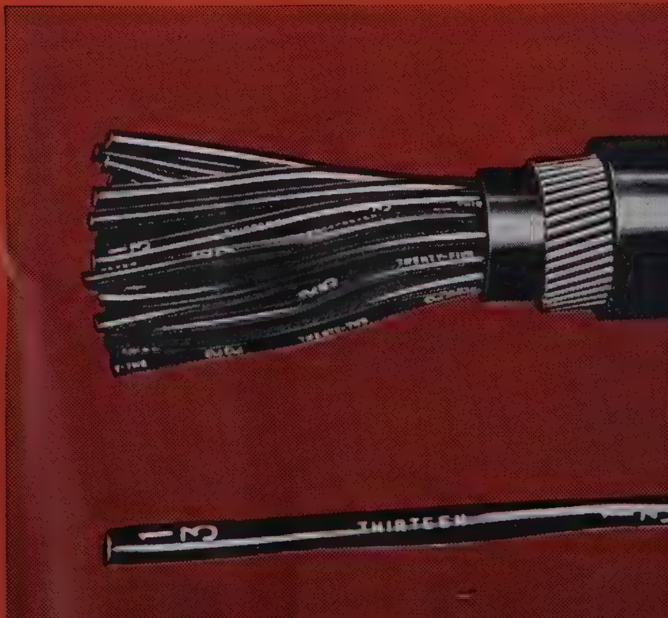
Further details on request.



PILOT AND CONTROL CABLES

A range of power and control cables is available at voltages up to 1,100. To facilitate identification, the P.V.C. insulated cores are clearly printed at frequent intervals with the appropriate legend and numerals. The laid up cores are sheathed with P.V.C. and can be armoured and P.V.C. protected if required.

Further details on request.



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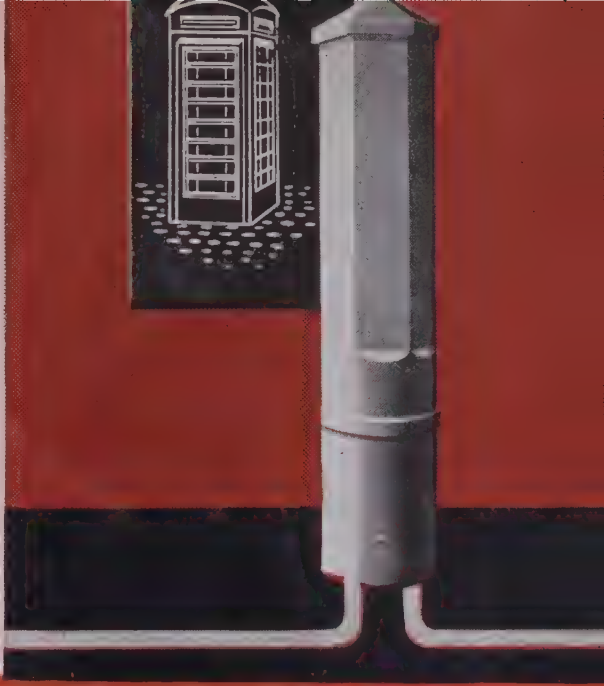
Connollys plastic insulated and sheathed cables are servicing telephone administrations throughout the world. Cables can be armoured with protected galvanised steel if there is a danger of mechanical damage, or they can be supplied with inbuilt catenary for overhead suspension. All cables are suitable for installation in tropical conditions.

Send for publication B.11A (Polythene Insulated)
and publication B.14A (P.V.C. Insulated)



FOR CABLES

WIRING SYSTEM CABLES

Connollys stock a wide range of plastic insulated and sheathed cables in accordance with B.S. 1557 (Polythene insulated, P.V.C. sheathed) and B.S. 2004 (P.V.C. insulated, P.V.C. sheathed).

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'Blackley' Tape has been produced by Connollys since 1895 and its adhesive and insulating properties are appreciated throughout industry. The adhesive surfaces never 'strip' because the rubber compound is frictioned on to both sides of specially woven cloth. Available in widths ½″ to 2″ in 5, 10, 25 and 50 yard rolls.

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CL 54

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The material is ideal for contact support springs, especially in miniature components, and is supplied as strip in the precipitation-hardened condition. All spring-forming operations can be performed without the need for further heat-treatment. Finished parts to users' drawings can be produced.

Full technical details on request

Higher current capacity
... no heat-treatment

Typical Properties of Mallory 53	
Specific gravity	**8·5**
Vickers hardness	**195 – 220**
Tensile strength, *tons per sq in*	**40 – 45**
Elongation, *per cent (2 inches)*	**12 – 16**
0·1% Proof stress in tension, *tons per sq in*	**30 – 35**
Electrical conductivity, *per cent I.A.C.S.*	**40 – 45**
Thermal conductivity, *c.g.s. units*	**0·42**

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Street Lighting

When engineers at the General Electric Company Ltd., Shaw, designed their auto-pumping and filling equipment, they relied on *VARIAC continuously-adjustable transformers for stepless regulation.

The plant illustrated is used in the final stages of sodium lamp manufacture, automatically cycling the pumping, baking and filling.

Whenever a stepless A.C. control is needed a VARIAC is usually available from our range of over 300 models. For normal single or three-phase supplies ratings up to 25.2 kVA are standard designs, but other special ganged assemblies can be offered for heavier duties.

VARIACS are compact in design, relatively light in weight and have the exclusive *DURATRAK contact surface to resist oxidation and permit initial surges up to ten times the rated current.

OUR CATALOGUE IS AVAILABLE ON REQUEST.

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Photographs by courtesy of The General Electric Company Ltd.

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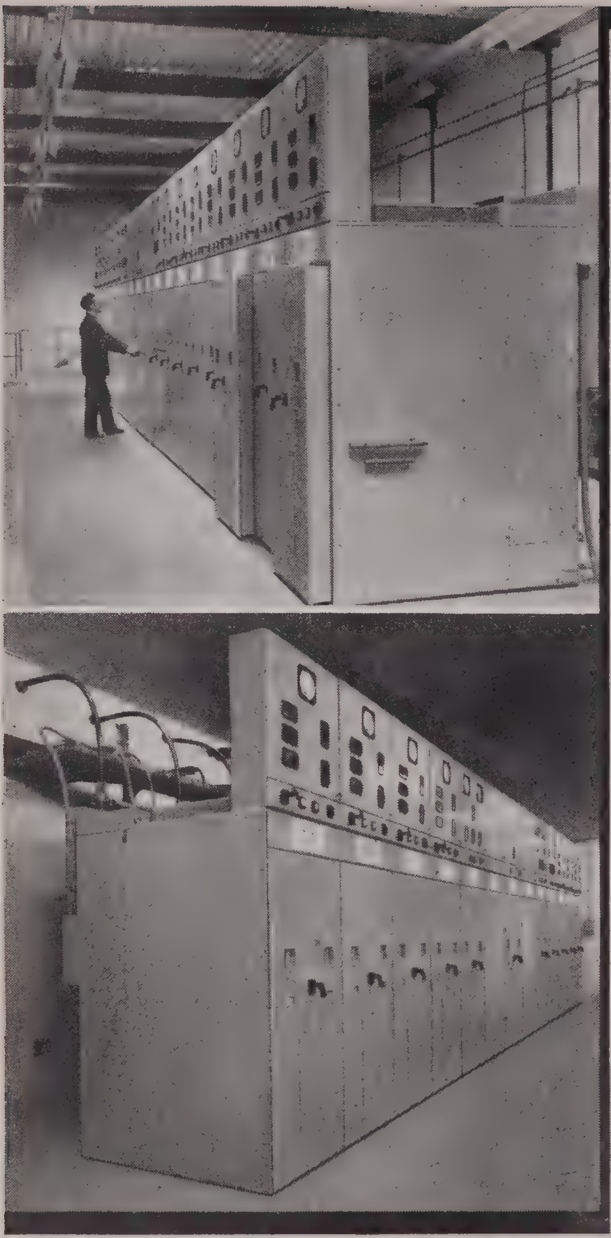

Photographs by courtesy of The Steel Company of Wales and the South Wales Electricity Board

THE STEEL
COMPANY
OF WALES

VELINDRE
WORKS

The electrical distribution within the Velindre Works is controlled by Reyrolle 3·3-kV 150-MVA air-break circuit-breakers.

Reyrolle also supplied the 33-kV 1000-MVA outdoor small-oil-volume circuit-breakers controlling the incoming supply.

CONSULTING ENGINEERS: McLELLAN & PARTNERS

Reyrolle

A. REYROLLE & CO. LTD • HEBBURN - COUNTY DURHAM - ENGLAND

Maximum legibility and good taste are combined in the Gents wall clocks shown here.

Styled by a leading industrial designer they provide a choice of standard models which fit happily into present-day surroundings and décor.

These and others in the extensive Gents range have been selected by the Council of Industrial Design for inclusion in Design Index.

All are available for operating either on A.C. Mains or as part of a Master Clock System.

Most models are now available from stock
Full details and literature on request

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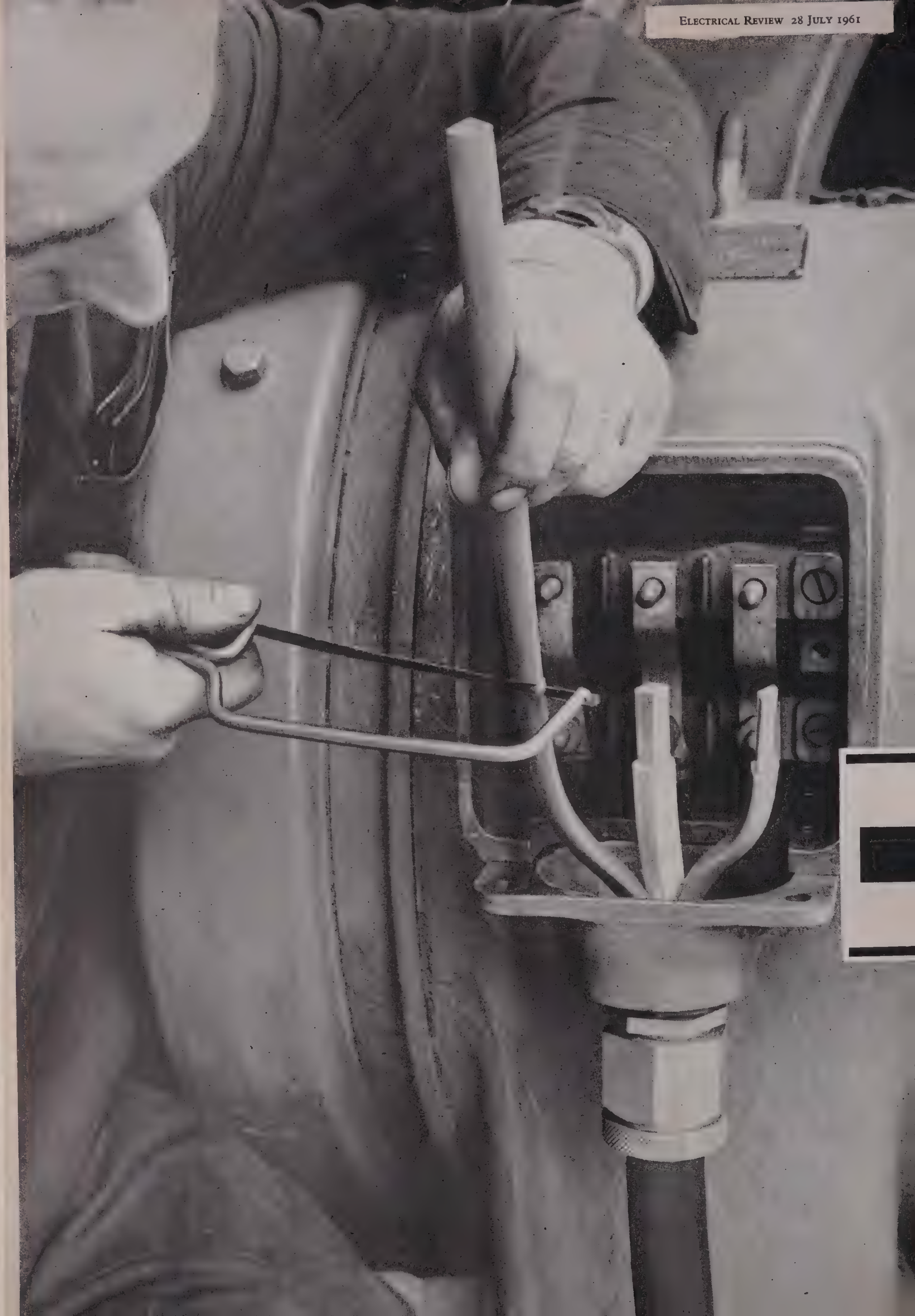
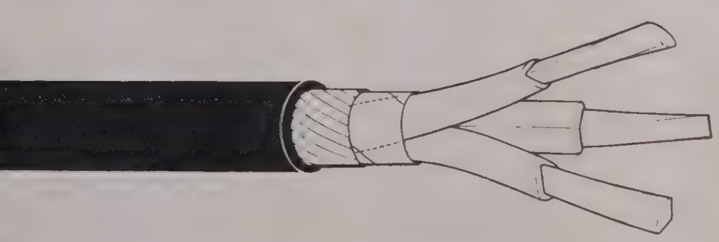


This cable costs less and is easier to lay and joint —it's **Solidal**

Solidal—the insulated cable with conductor cores of solid aluminium—is light, compact and cheap. It is readily manipulated and easy to lay and joint. Now available from leading cable makers, Solidal offers real economic advantages. Its design and development are an example of the forward thinking and research resources of Alcan, which could be of help to you too. If you have a problem that aluminium might solve, why not get in touch with your nearest Alcan office?



COMPACT, LIGHT AND EASY TO JOINT

the solid sector-shaped conductor cores are of extruded aluminium each insulated by appropriately coloured PVC, the whole is lapped with clear tape. Outside this, a single layer of rectangular, hard aluminium wire is wound, serving the double purpose of armour and neutral. Over all is extruded the outer sheath of PVC. Solidal was developed by Alcan.

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FORMERLY NORTHERN ALUMINIUM CO. LTD.

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ALCAN

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Photo by courtesy of Chief Mechanical & Electrical Engineer, B.R. (W.R.) Swindon

. . . Overhead Busbar Trunking is now widely used for the distribution of electrical power to large numbers of machines and electrical equipment. Revo Electric can supply trunking to cover your specific requirements. Standard busbar sections each 12ft. long with plug-in positions every 2ft together with right angle bends and T junctions and fused plug-in boxes enable installations to be quickly carried out. May we quote you?

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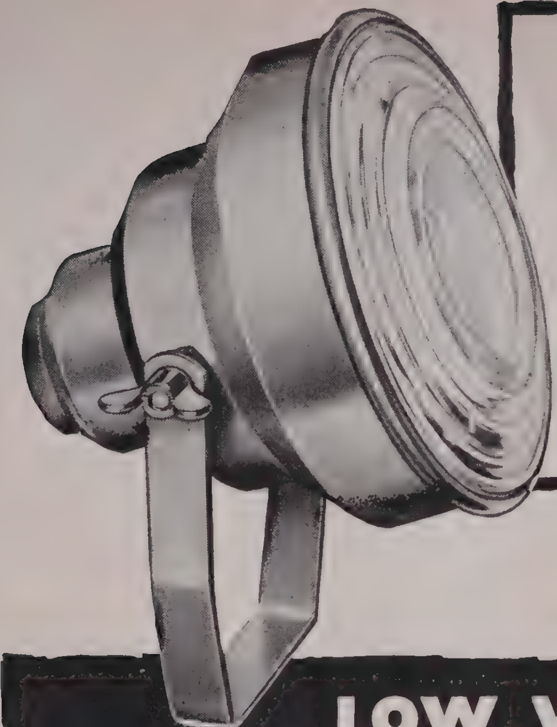
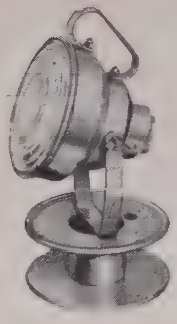
W & W 86



Designed for use with 38 m.m. vehicle bulbs. This Unit can be supplied with heavy stirrup for fixed mounting, or for transportable use with carrying handle and heavy steel drum stand for housing trailing cable. *Full details on request.*



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LOW VOLTAGE HEAVY DUTY FLOODLIGHT

ROWLANDS ELECTRICAL ACCESSORIES LIMITED, R.E.A.L. WORKS, BIRMINGHAM, 18

‘WRIGHT’ *Motorised Heavy Duty* GRINDING SPINDLES

are readily adaptable for surface grinding and internal grinding, when used as
ATTACHMENTS ON BORING MILLS, PLANING MACHINES AND HEAVY LATHES, ETC.

Illustrated are two Type HRF/S units fitted with slanted side flanges (feet) for slide rest mounting, having, respectively, 12″ and 18″ snout extensions.

★ ★ ★ ★

The motors used in the construction of our Grinding Spindle units are of the squirrel cage, totally enclosed dust proof type, and are available in ratings of 2 B.H.P. at 2800 R.P.M. and 2 and 3 B.H.P. at 1450 R.P.M. A.C. 3 phase, any one standard voltage. Designed with oversize nickel chrome spindles, carried in precision ball thrust and roller bearings, the complete rotors are dynamically balanced.

The rigid steel stator can be fabricated with any shape of FIXING FOOT (DRILLED or undrilled; with or without TONGUE), SHANK, BRACKET, END FLANGE, etc. for SLIDE REST mounting, TOOL POST mounting, etc., to suit CUSTOMERS' SPECIAL REQUIREMENTS.

Snout extensions are available from 4½″ up to 18″.

★ ★ ★ ★

The Type HGR units are fitted with sliprings to permit “planetary grinding” where the work piece is stationary and the grinding spindle is mounted on the face-plate of the machine tool.

The Types HGR are available with standard snout extensions of 6″, 12″, 18″ or 24″.

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Manufacturing Electrical and Mechanical Engineers

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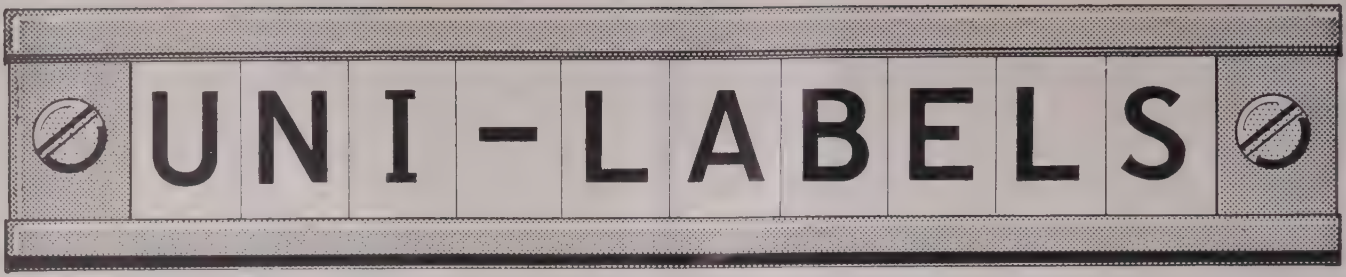

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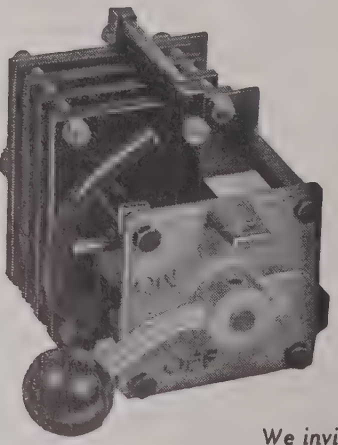

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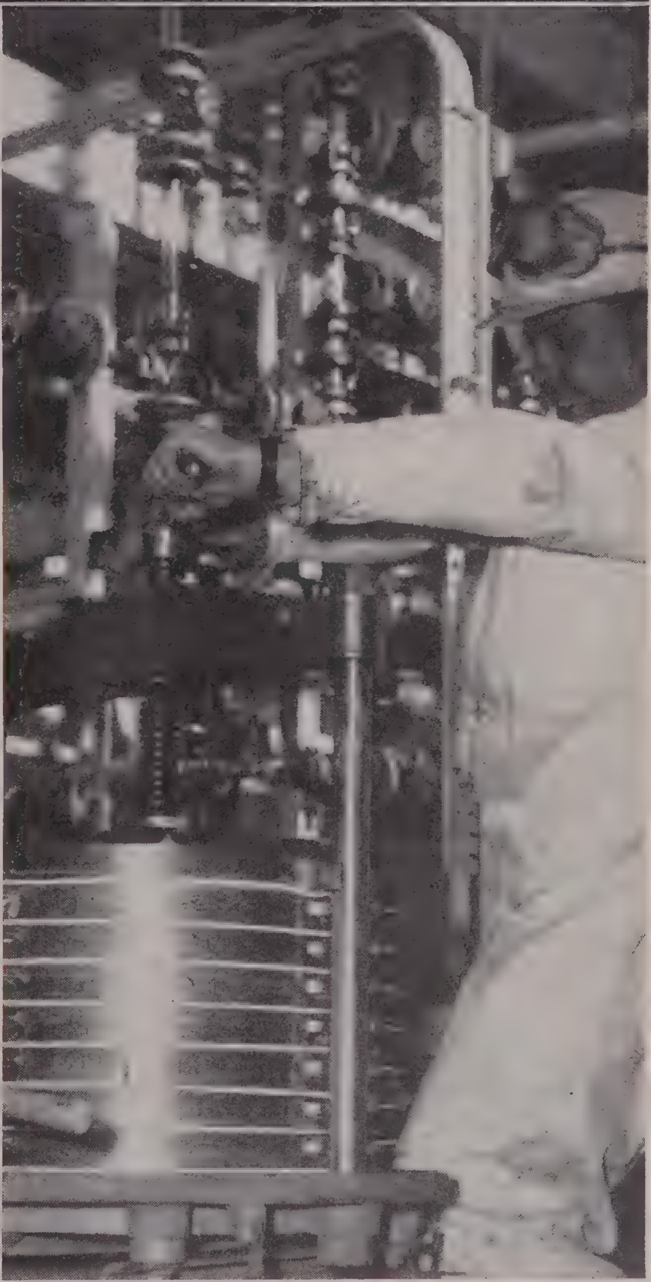

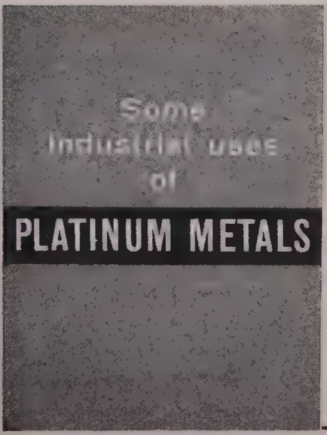

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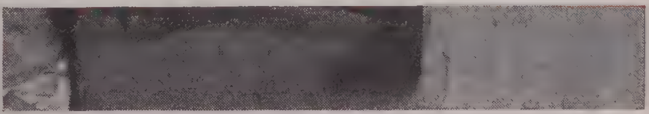

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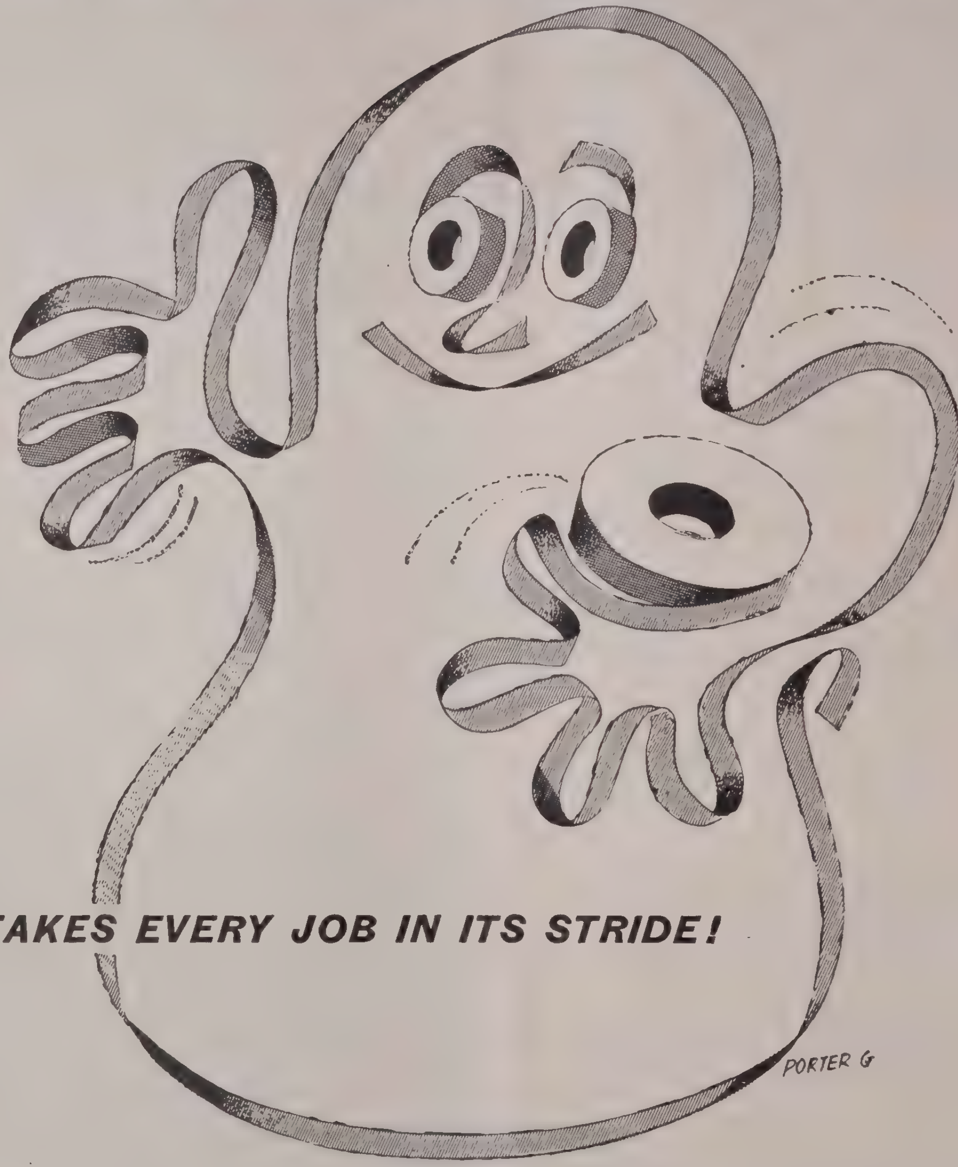
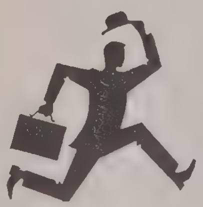


YET IT TAKES EVERY JOB IN ITS STRIDE!



Lasso No. 92 has so many properties, so many uses, we could fill this page with them. And dull reading it would make. A lot of stuff about pliability, water resistance, acid resistance, wrapping, jointing, insulating, binding, splicing—*that* sort of thing. Far better send for our alert young representative, *he* makes it sound interesting. Ask your secretary to drop us a line today.

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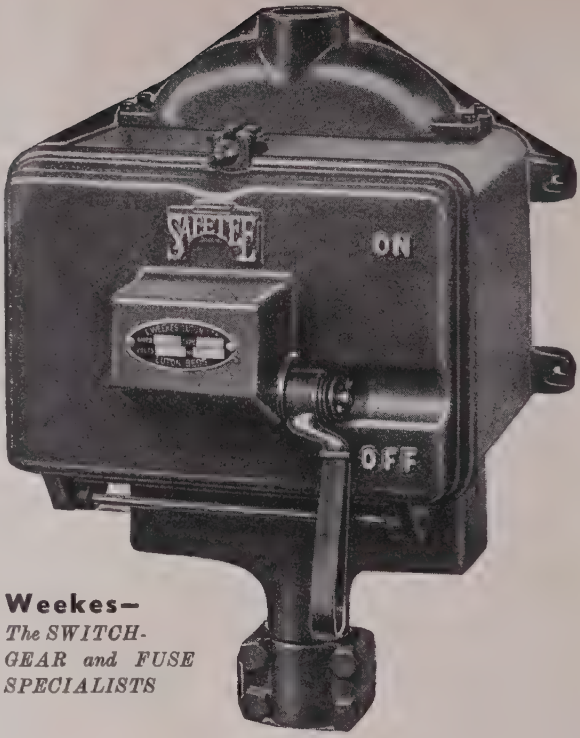

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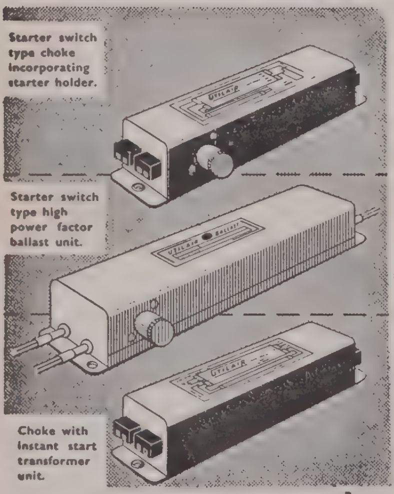
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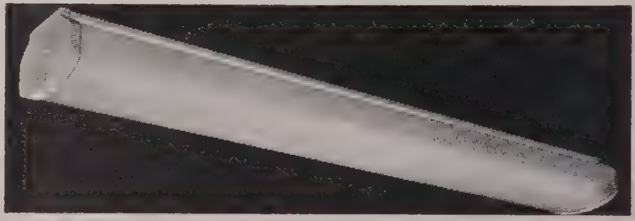
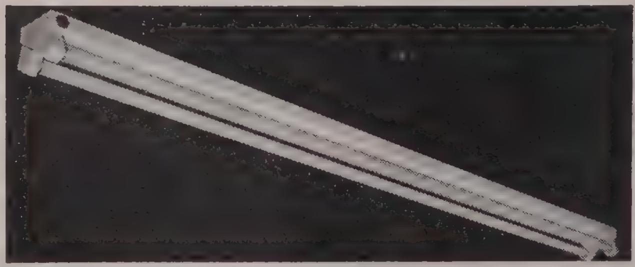


Model EP.802 Suspended or ceiling fitting with opal fluted diffusing cover



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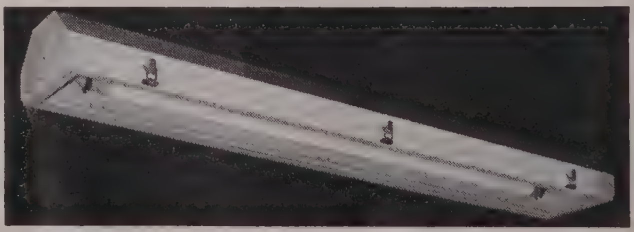

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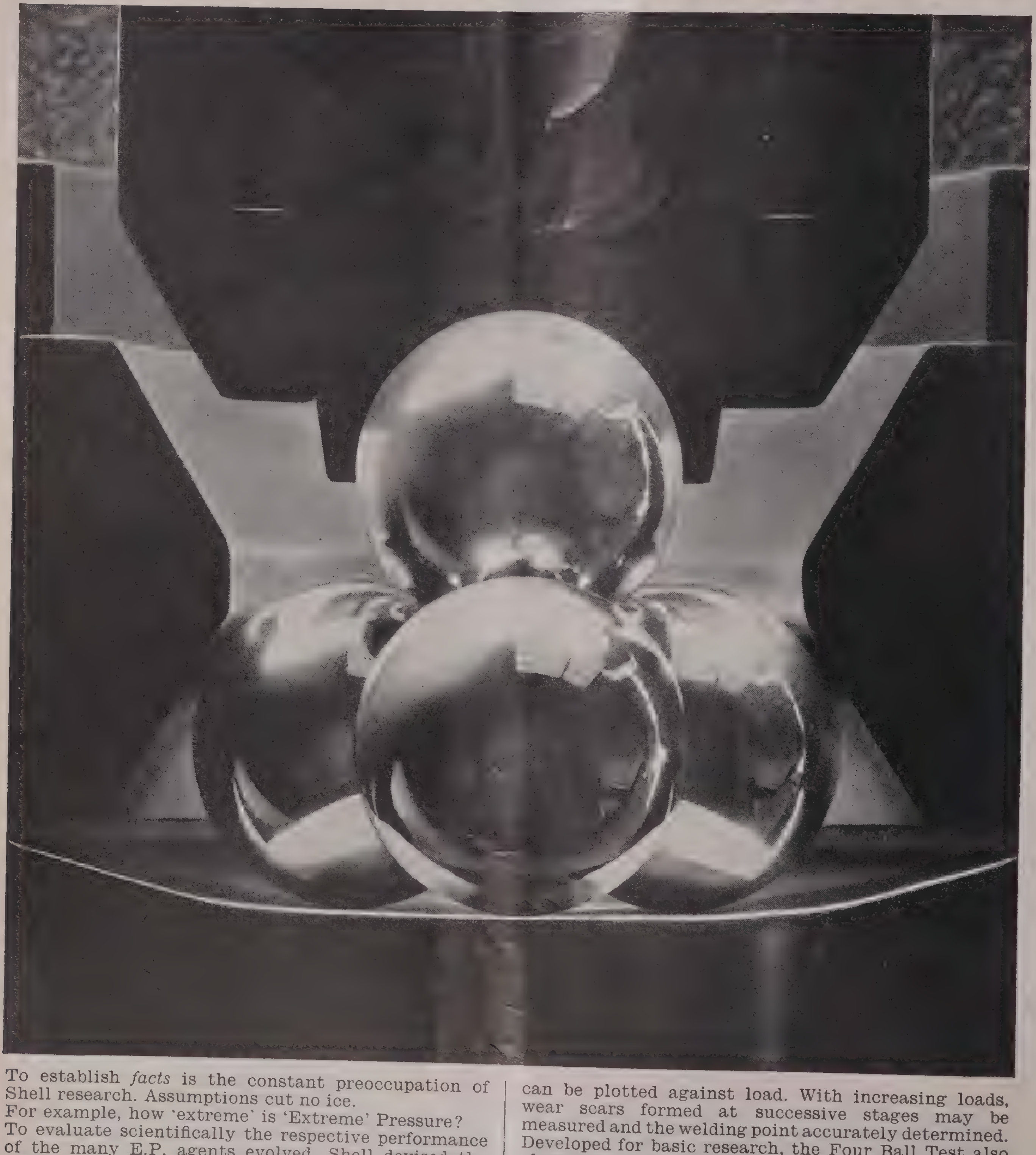
ABRIDGED DATA

Absolute Maximum Ratings (limiting values)

Maximum recurrent P.I.V.	200V
Maximum transient peak voltage	400V
Maximum surge peak voltage (max. duration 10 ms)	400V
Minimum breakdown voltage	800V
Maximum average forward current	20A
Maximum recurrent peak current	100A
Maximum surge current	600A
Maximum junction temperature	150 C

MIS 34

Shell demonstration



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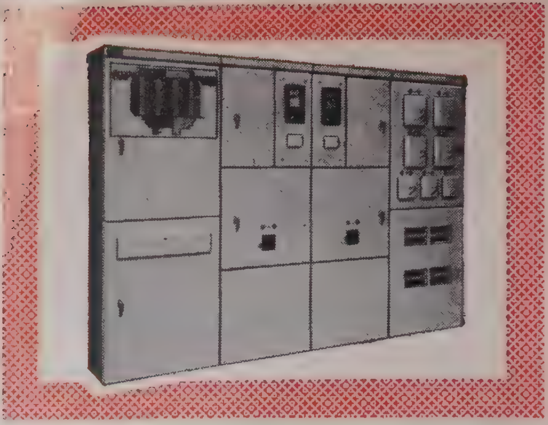
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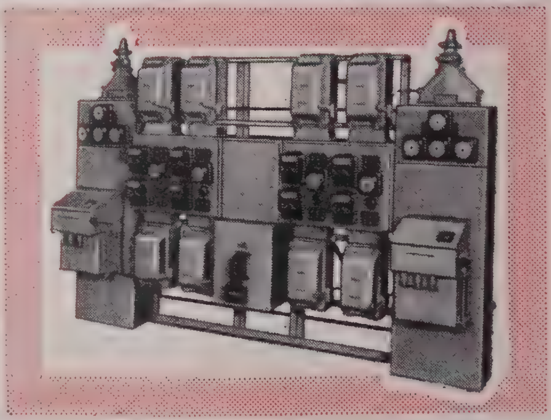
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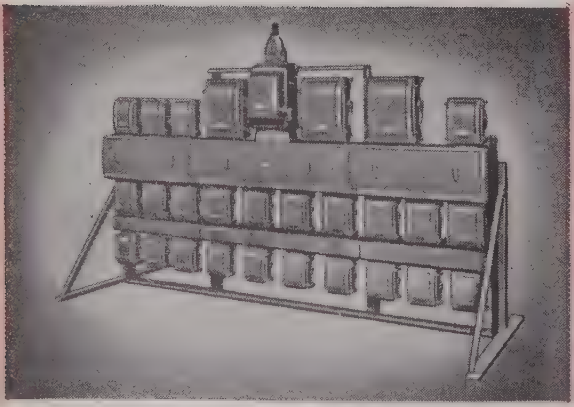
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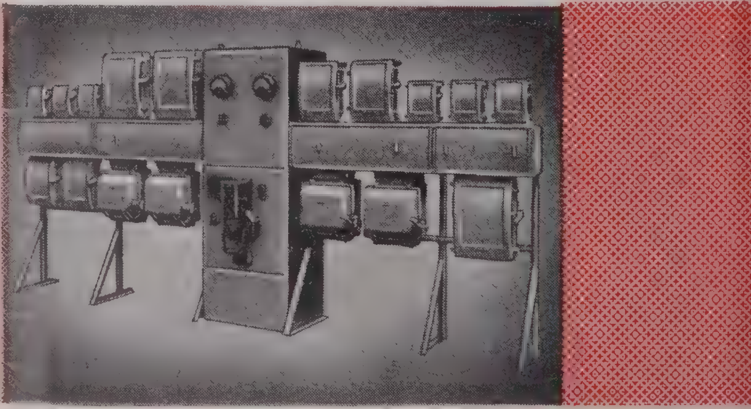
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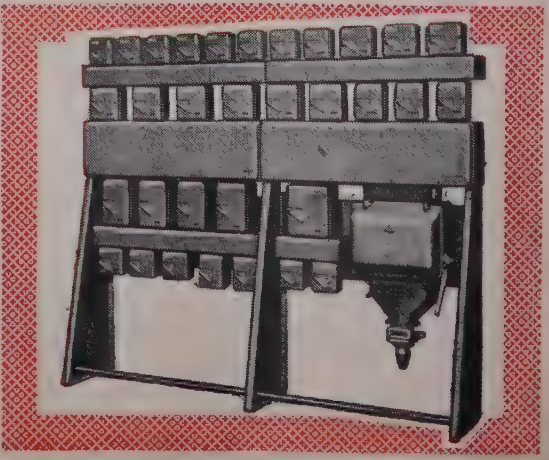
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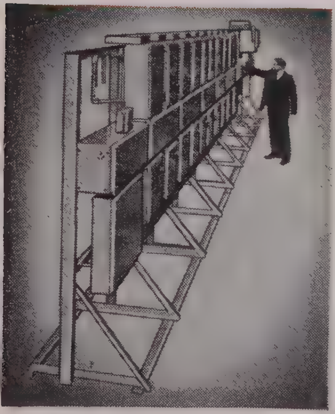

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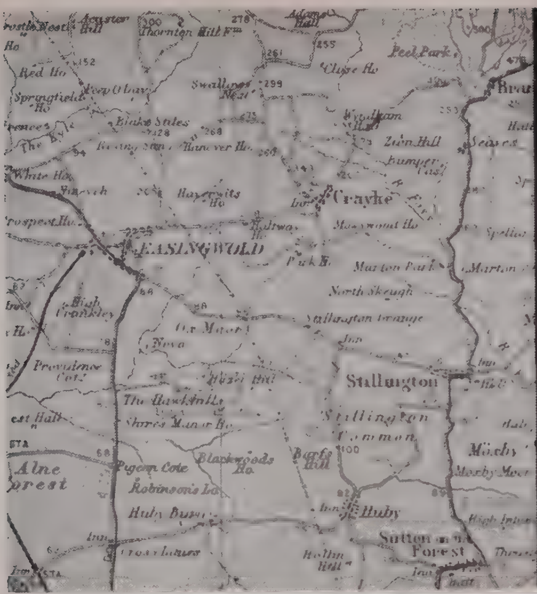

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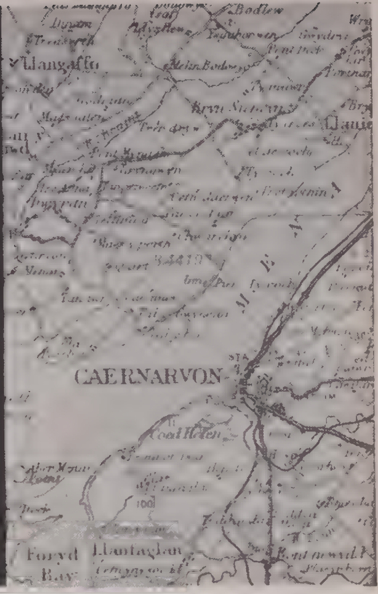

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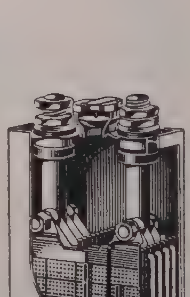

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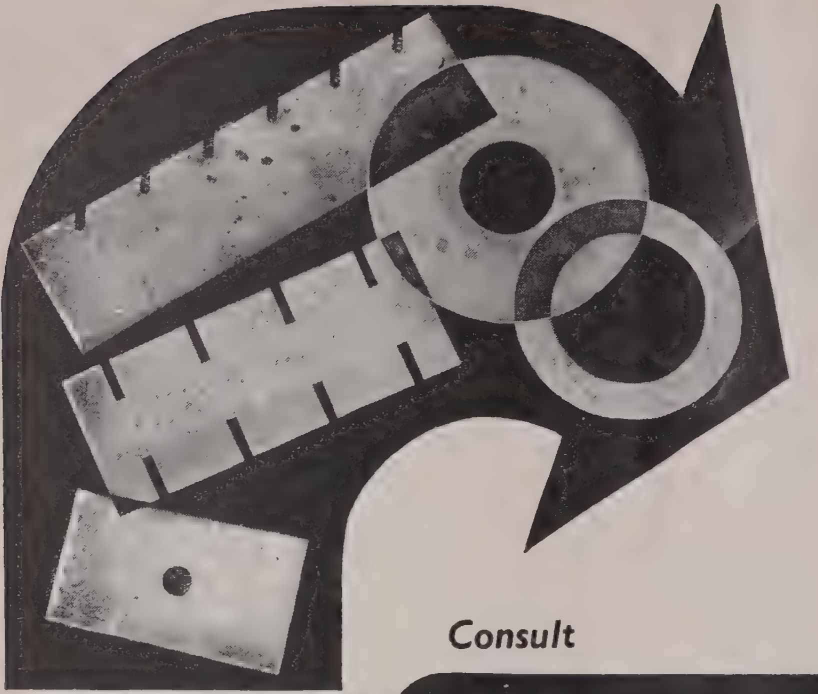

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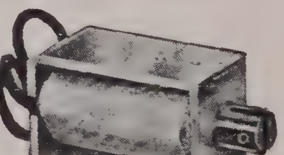

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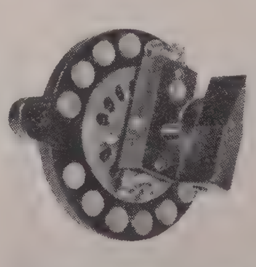

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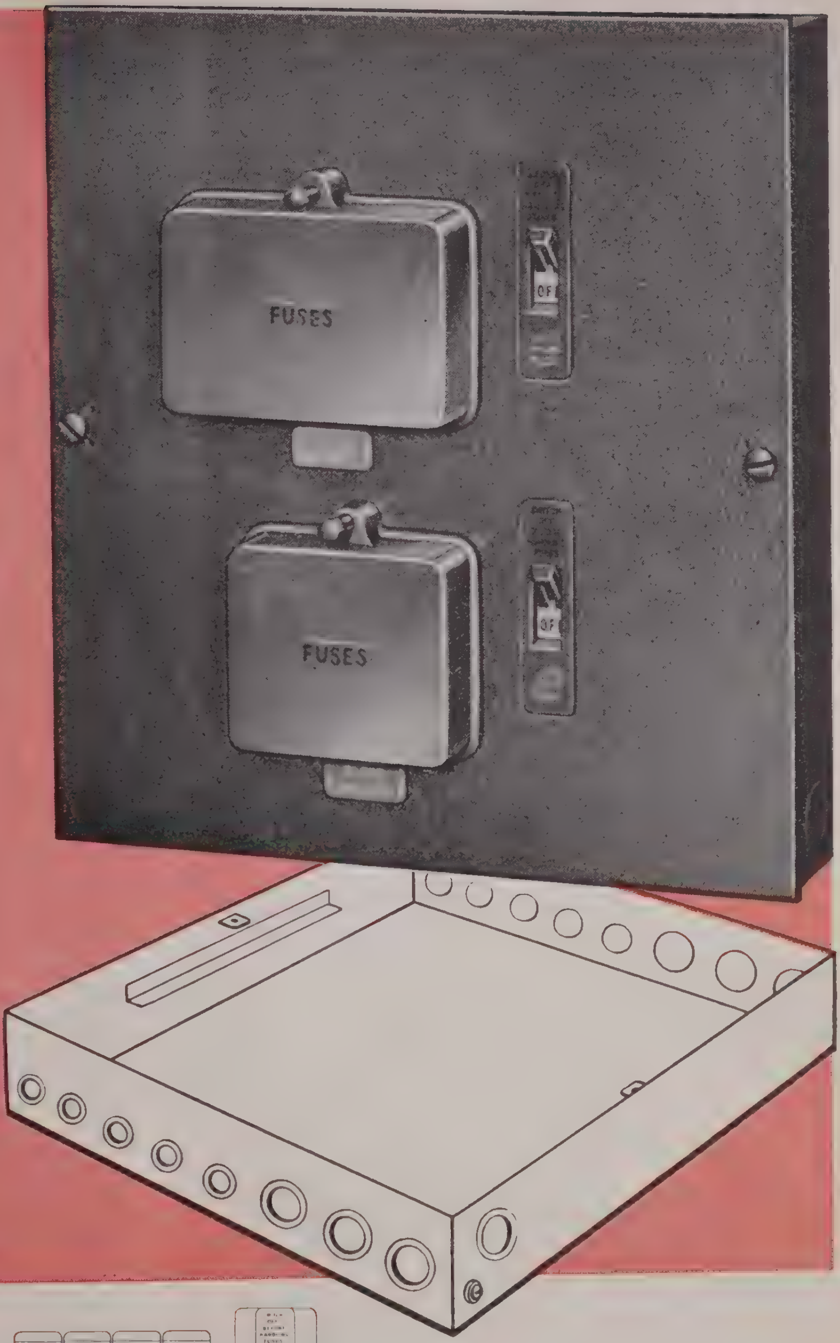
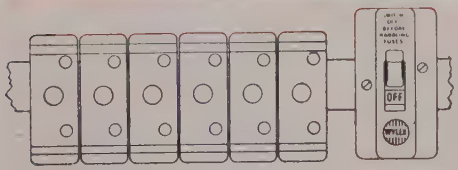
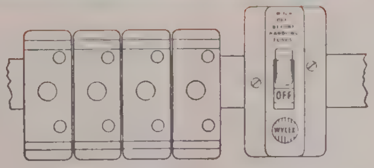
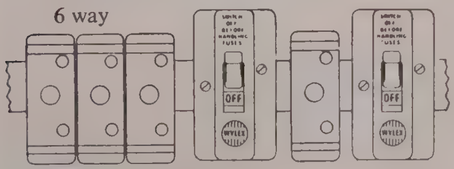



6 way


4 way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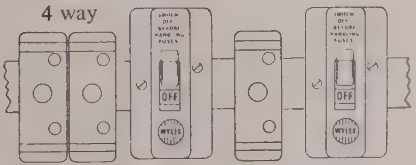
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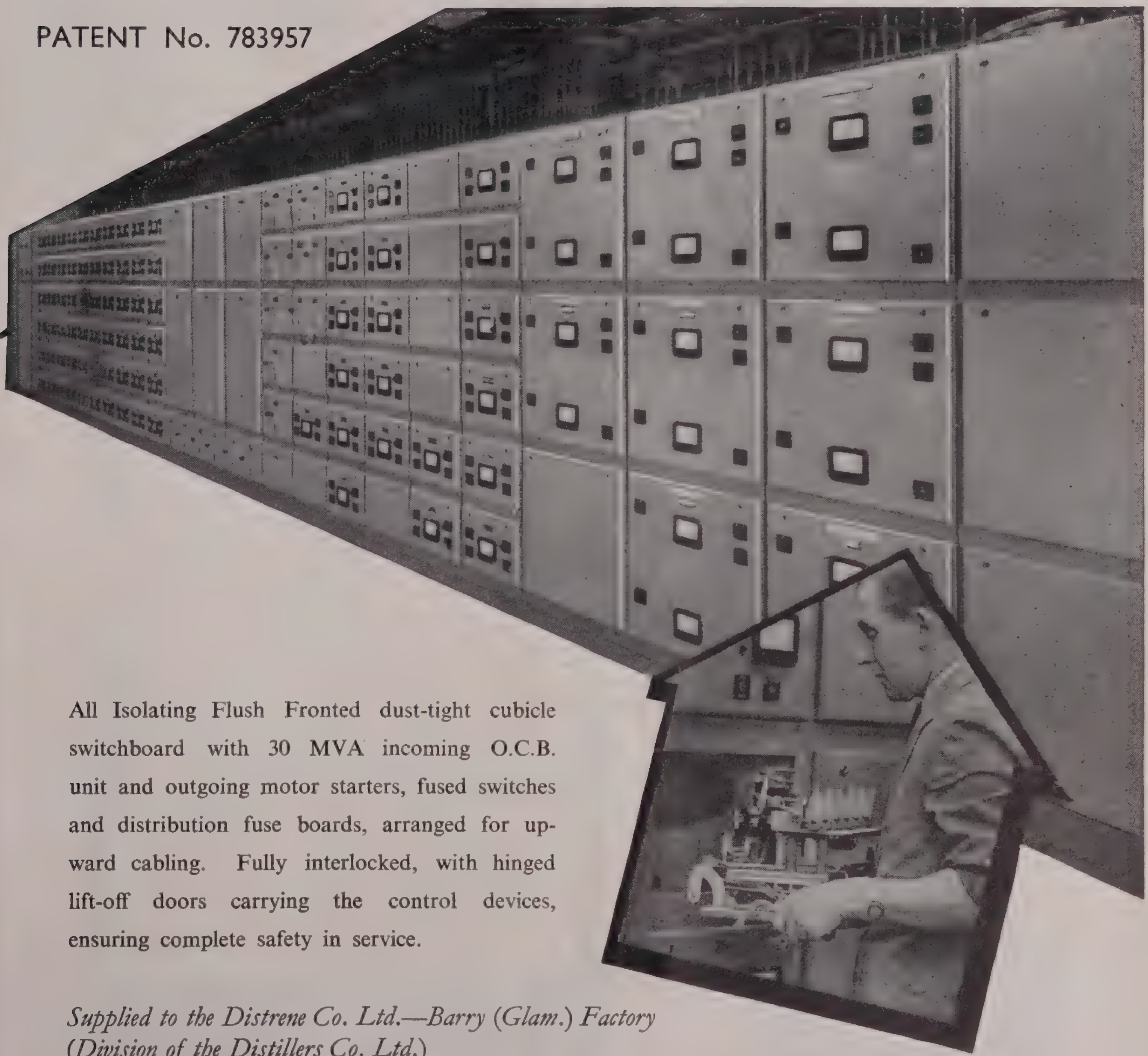

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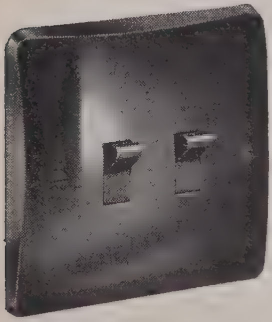

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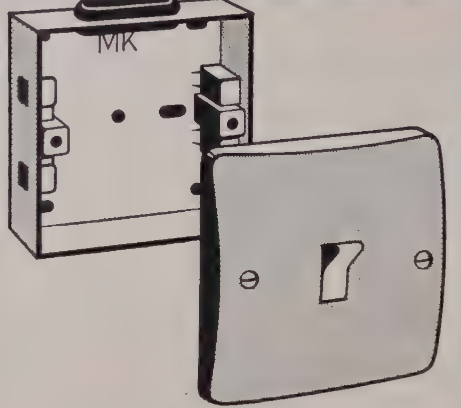

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ELECTRICAL REVIEW

Friday 28 July 1961 Volume 169 No 4

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Managing Editor:
HUGH S. POCOCK, M.I.E.E.

General Editor:
J. H. COSENS

Technical Editor:
A. R. POLLARD, A.M.I.E.E.

Iliffe Electrical Publications Ltd.
Managing Director H. S. Pocock, M.I.E.E.
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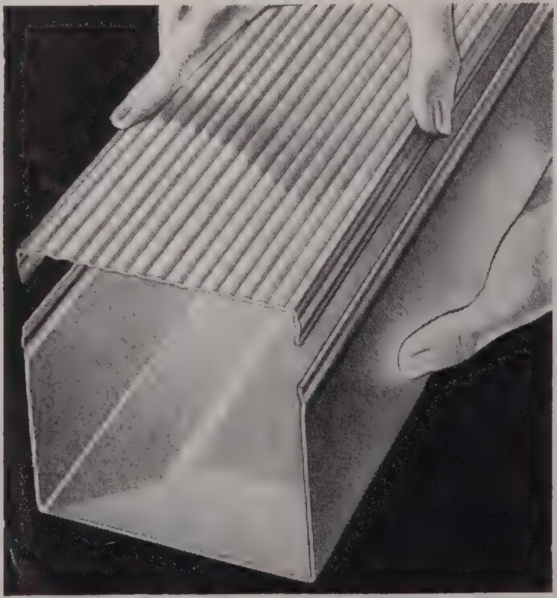

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ELECTRICAL REVIEW

28 July 1961 Vol. 169 No. 4 Established 1872

The I.E.E. and Electronics

SEVERAL times during recent years we have referred to the excessive drift towards electronics and allied subjects in the proceedings of the Institution of Electrical Engineers. To us it would appear that far too much emphasis is being placed on one subject for an Institution whose Royal Charter states that its purpose is " to promote the general advancement of electrical science and engineering and their applications and to facilitate the exchange of information and ideas on those subjects."

Only last month the Council of the Institution made an announcement to the effect that the high proportion of the Institution's activities which is devoted to the science, development and application of electronics was not so widely recognised as it might be. This pronouncement we do not understand because, for example, in the 1960–61 session the Electronics and Communications Section had 71 papers and 16 meetings, the Supply Section had 20 papers and nine meetings, while the Utilisation Section had 21 papers and eight meetings. The Measurement and Control Section, whose interests are mainly of an electronic nature, had 40 papers and 15 meetings. This means that electronic engineers were presented with 111 papers while power engineers only had 41. This is not because there is a preponderance of electronic engineers in the membership of the Institution; according to the latest figures there are some 10,813 members in the Supply and Utilisation Sections, while the other two Sections have 10,022 members. Furthermore, the average attendance at meetings seems to be about the same. In the same year four conferences were held by the Institution and each of them was concerned with some application of electronics. In view of this we would suggest that the emphasis which is placed on electronics by the Institution is completely out of proportion since the numbers of members of the electronics and power sections are approximately equal.

On top of all this the Institution has now announced a reorganisation of the specialised sections, and again this seems to be for the benefit of electronic engineers. The four specialised sections have now been replaced by three Divisions, two of which will represent " Electronics " and " Power " interests while the third, a " General " Division, will cover activities of common interest to electrical engineers such as basic measurement and technological education. In setting up this divisional structure the Council say that they are recognising the increasing importance of electronics in electrical engineering, and the part being played by electronic engineers in the work of the Institution which has resulted in its present position as the professional home of electronic engineers. It is hoped to put this new scheme into operation at the beginning of the 1962-63 session. It would seem to us that the Institution has got the subject of electronics completely out of proportion with other aspects of electrical engineering. Obviously, electronic engineering is of growing significance and importance but we should not allow it to swamp everything else. If this trend continues there seems every possibility that before long the proceedings of the Institution will contain little of interest to power engineers.

No doubt the Council is concerned because many young electronic engineers do not nowadays join the I.E.E., but surely sufficient incentive was given to these men when the decision was made last month to review the examination syllabuses and training regulations with regard to the electronic engineers, to ensure that no obstacle lay in the path of any such suitable qualified person being admitted to membership.

C.E.G.B. AND THE CONSORTIA

It has always seemed to us (and, of course, to the companies concerned) unfortunate that the heavy cost of preparing tenders for nuclear power stations should fall entirely on the tenderers. This is accepted practice in the case of most contracts, but the companies were justified in regarding this work as something out of the ordinary run.

Evidently the Central Electricity Generating Board has some sympathy with this view for it has decided that, subject to each individual case, it will be prepared in future to pay £100,000 to each consortium sending in a satisfactory comprehensive tender, as a contribution to the cost of preparation. The sum is related to the expense in which the Board itself would be involved in the exploratory work necessary on the sites of these stations.

Most of the companies participating in nuclear power work have had to provide against losses and so they will no doubt appreciate the Board's " gesture."

THE VALUE OF COMPUTERS

Last week we saw a demonstration of computers which formed an excellent illustration of the value of these machines. The computer concerned was a Remington Rand " Univac " and it was calculating and printing electricity bills, taking into account such things as one consumer having several meters, each on a different tariff, hire-purchase, maintenance charges and so forth. The computer also presented a statistical analysis of the entire billing run. This will no doubt be of great interest to both Electricity and Gas Boards. One of the most difficult tasks when operating a computer is the programming, and it is of interest to note that this particular electricity billing job was programmed in only six man-weeks. This type of computing saves a great deal of time and in fact the manufacturers first used it to do their own sales and costing, comparing its operation with that of a conventional punched card system. The computer did this job in 90 minutes, while the punched card system took eight hours.

ELECTRICAL REVIEW INDEX

The index to Volume 168 of the *Electrical Review* (January — June, 1961) will be found at the back of this issue. It is easily detachable for binding with the volume or to be used for reference purposes.

FALSE IMPRESSIONS

In this country, exhibitions are divided into two classes, technical and non-technical. Technical exhibitions are aimed solely at the specialist and even if the general public are not actually debarred from the show, they are not actively encouraged to attend. Non-technical exhibitions, for example, the Ideal Home Exhibition and the Radio Show, are mainly concerned with external appearances of consumer goods. British technical achievements are not sufficiently publicised.

In contrast to this state of affairs, the Soviet exhibition at Earls Court puts considerable emphasis on Russian technical achievements, particularly in nuclear energy. None of the displays showed principles or devices which have not already been used or manufactured in this country. Yet we were amazed at the number of people who said that they thought that the Russian achievements shown were magnificent. They obviously did not realise that there were such places as Harwell or Calder Hall. These false impressions must be counteracted, preferably by a similar exhibition of British achievements in this country.

ACADEMIC TRADITIONS

Methods of teaching electrical engineering are at present undergoing a transition. Fundamental principles are, at last, receiving new logical and extended treatments in preference to the traditional considerations of apparently unrelated, unreal and outdated theories. A thorough grounding in basic theory is vital to all electrical engineers and any extra time spent on this study cannot be wasted. It may even be found profitable to scrap all degree level courses in electrical engineering in favour of applied physics, although this may seem to be a rather drastic measure.

Evidence of some notable changes in teaching electrical engineering could be seen in the laboratories at a recent open day held at the Northampton College of Advanced Technology in London. Special projects undertaken by students in their fourth year were very impressive but some traditional and, to our mind, rather useless and time-wasting experiments were still being carried out in the earlier years. In sandwich courses of the type conducted at the Northampton College, more useful practical information than that provided by the usual experiments can generally be obtained during the student's time in industry.

Induction Regulators for Voltage Control

By K. K. SCHWARZ, M.A., A.M.I.E.E.*

After discussing the general utility of induction regulators, the author analyses the performance of a single induction regulator in buck-boost connection, including derivation of currents, voltages and other characteristics. For comparison, a similar analysis is made for a variable impedance, i.e. saturable choke control with a constant resistance load and its basic characteristic curves derived. After considering the double induction regulator, a summary of some typical induction regulator/transformer combinations indicates the correct method of designing a system to get the best performance and most economical arrangement

Although induction regulators have been and are being used in very large numbers for the control of stator-fed a.c. commutator motors,[1] the application to more generalised voltage control problems has not been as wide as might be expected from a consideration of the intrinsic qualities of these devices. However, in recent years the requirements for controlling large a.c. powers, coupled often with requirements for highly organised automatic control systems, have resulted in an increasing interest in induction regulators.[2]

Basically, the induction regulator is a multi-phase a.c. slip-ring machine used in a quasi-stationary manner, i.e. working with a fixed mechanical displacement for any given output. It is therefore usual to replace the slip-rings with stationary flexible connections, thus avoiding any potential contact problems. An induction regulator equipment is normally associated with transformer equipment, so that the general mechanical arrangements tend to be a combination of rotating machine and stationary transformer technology. For example, induction regulators are supplied with air or oil cooling, depending on particular requirements and economic and design considerations. One of the most important aspects of the correct application of induction regulators is the correct overall system design in order to achieve an economical arrangement, both in first cost and running performance, as well as the maximum operational efficacy from the point of view of voltage control.

Basic Principles

The basis of all induction regulator systems is the single induction regulator consisting of an arrangement of two concentric magnetic cores, "stator" and "rotor," separated by an air gap, one core carrying a "primary" winding and the other a "secondary" winding. By displacing the secondary winding in space with respect to the primary winding, as indicated in Fig. 1a, a phase shift of the voltage is obtained, as indicated in Fig. 1b, with constant voltage output, ignoring the internal impedance drop due to load current. This is the first significant feature of the single induction regulator; i.e. it is a machine working with constant flux and producing a constant output voltage of variable phase. The practical machine has an internal impedance drop similar to that of an equivalent rotating machine and also takes a constant magnetising current from the line.

There are some applications where the single induction regulator is used for phase-shifting purposes, but these are relatively rare. A single-phase induction regulator is used only occasionally, but its characteristics can be simply deduced from those of the multi-phase machine.

The simplest method of obtaining a variable-voltage output from a single induction regulator arrangement is by using what is known as a "buck-boost" connection with a fixed voltage supply as indicated in Fig. 2a. The equipment is shown for a normal three-phase arrangement with the primary (low-current, high-voltage) winding on the rotor, to minimise the size and number of the flexibles

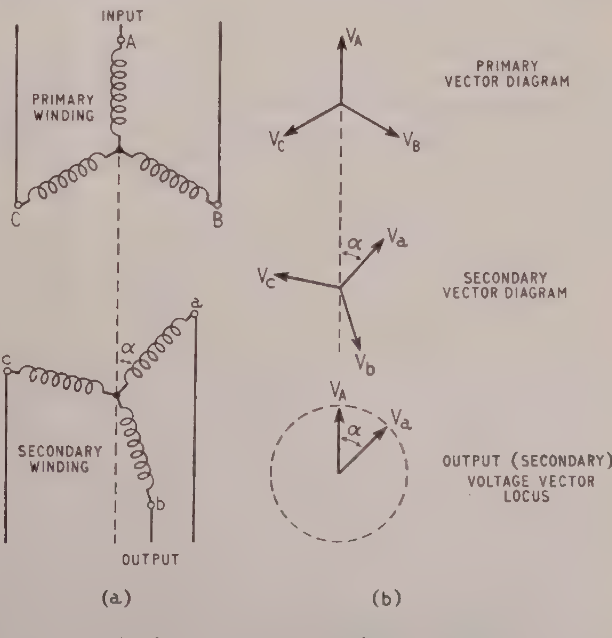

Fig. 1.—The basic single induction regulator
(a) Connection diagram. (b) Voltage vector diagram (one phase only shown)

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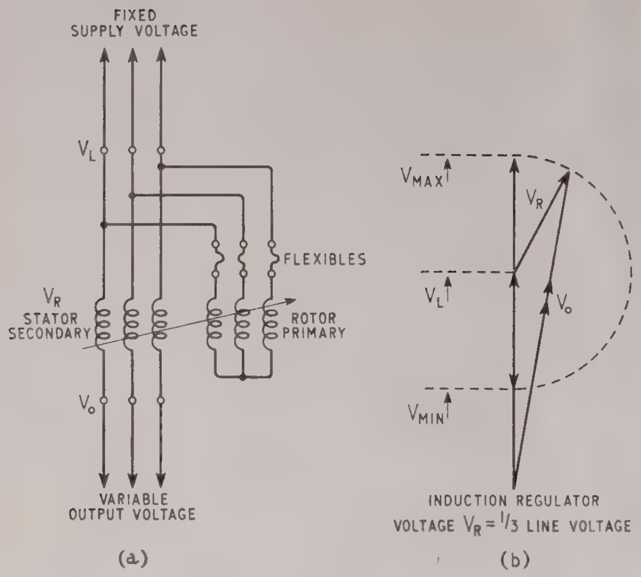

(a) (b)

Fig. 2.—The basic buck-boost single induction regulator
(a) Connection diagram
(b) Voltage vector diagram (one phase only shown)

connected to the supply. The six-terminal (high-current, low-voltage) secondary winding on the stator is connected in series with the supply. The output voltage vector describes a circle as indicated in Fig. 2b.

As the equipment is a true voltage control arrangement, the output voltage is affected to only a minor degree by the load current, which produces an internal voltage drop in the machine. This can be added to the voltage vector diagram in the usual way to make an accurate calculation of the performance.

It will be noted that with an induction regulator rating of one-third of the line voltage, as indicated in Fig. 2, the total voltage range is 3 : 1 between V_{min} and V_{max} with obvious economic and performance advantages. Moreover, a 3 : 1 voltage variation on a constant impedance load, such as a heater, results in a 9 : 1 output variation, which is adequate for many applications.

Fig. 3a shows a "buck-boost" single induction regulator connected to the line supplying a fixed resistance load. Ignoring the internal voltage drops of the machine, the voltage vector "circle" diagram, Fig. 3b, and the current vector diagram, Fig. 3c, show conditions under the following premises:—

(a) The output secondary voltage V_R of the single induction regulator is equal to the line voltage V_L.

(b) The load is a constant resistance R to which is applied the output voltage of the system V_O resulting in a load current I_O.

(c) The displacement angle of the single induction regulator is α, i.e. the angle between the direction of the line voltage V_L and the single induction regulator secondary voltage V_R is α. Consequently, the induction regulator primary current I_R is displaced from the induction regulator secondary current I_O (i.e. the load current) by the angle (180—α).

(d) The output voltage V_O is assumed to have a displacement β with respect to the line voltage V_L, which is also the displacement of the load current I_O with respect to the line voltage direction (for a unity power factor load).

(e) The line current I_L consisting of the vectorial sum of the single induction regulator primary current I_R and the load current I_O, is assumed to be displaced from the load current vector I_O by an angle γ.

(f) Whilst the voltage vector diagram 3b is drawn for a 1 : 1 voltage ratio of the induction regulator, the considerations immediately following are generally true for any given voltage ratio T.

Though it will be appreciated from basic considerations of kVA and ampere-turn balance that the line current must have the same power factor with respect to the line voltage as the load current with respect to the output voltage, whatever the output voltage phase may be with respect to the line voltage, this can be simply proved from the geometrical configuration of the current and voltage vector diagrams as follows:—

The turns ratio T of the single induction regulator determines both its current and voltage ratio, i.e.:—

$$T = \frac{V_R}{V_L} = \frac{I_R}{I_O}$$

The triangles $\hat{V}_R$-$\hat{V}_L$-$\hat{V}_O$ and $\hat{I}_R$-$\hat{I}_O$-$\hat{I}_L$ are therefore "similar" geometrically, as the included angle between $\hat{V}_R$ and $\hat{V}_L$ and $\hat{I}_R$ and $\hat{I}_O$ is α in both cases. (The induction regulator primary current I_R is identical to the induction regulator secondary current I_O apart from the turns ratio factor and the relative displacement between the windings, see (d) above, as shown on the current vector diagram 3c.

Inspection of the voltage vector diagram shows that the angle subtended between $\hat{V}_O$ and $\hat{V}_L$ is specified as β and therefore the angle subtended between I_L and $\hat{I}_O$ which was assumed to be γ, also equals β. Consequently the current vector $\hat{I}_L$ is parallel to the line voltage V_L, i.e. the power factor of the load current with respect to its own voltage and the power factor of the line current with

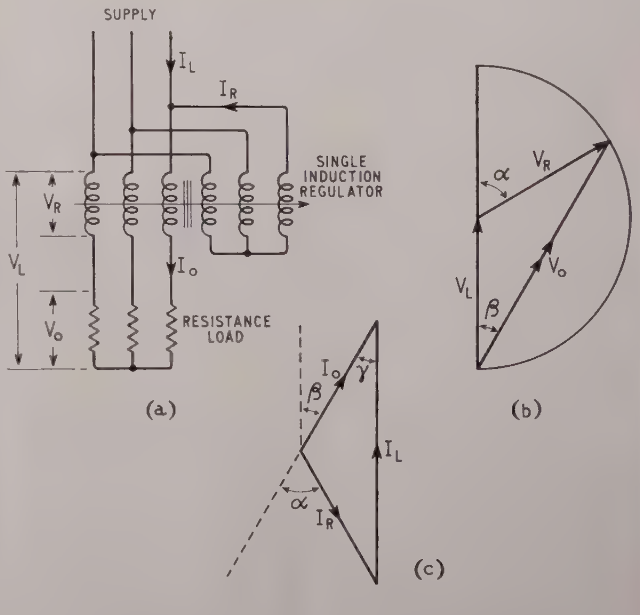

Fig. 3.—Single induction regulator in buck-boost auto-transformer connection with resistance load and voltage range to zero
(a) Connection diagram
(b) Voltage vector diagram (one phase only shown)
(c) Current vector diagram (one phase only shown)

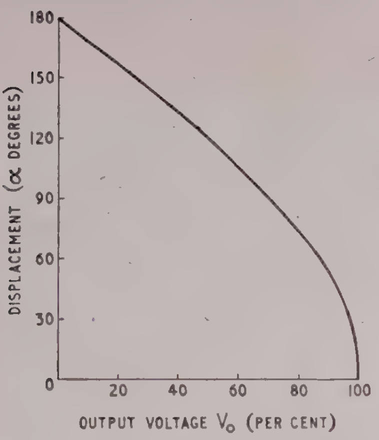

Fig. 4.—Output voltage/displacement characteristic of single induction regulator system of Fig. 3

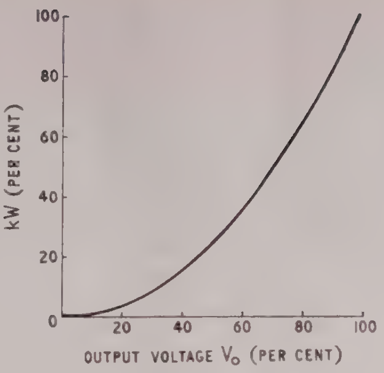

Fig. 5.—Output voltage/load power characteristic of single induction regulator system of Fig. 3

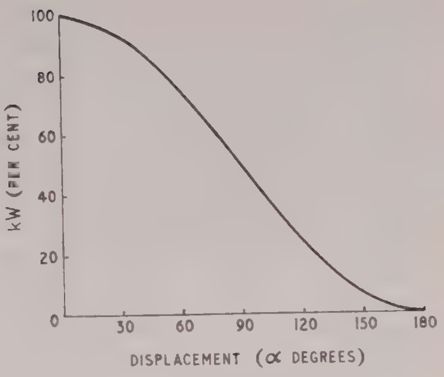

Fig. 6.—Displacement/output power characteristic of single induction regulator system of Fig. 3

respect to its voltage remains unchanged by the internal phase shift of the arrangement.

It will be seen immediately that the effect of the load power factor (cos ϕ) is simply to rotate the current vector diagram triangle by the angle ϕ relative to the line voltage direction, thus making the line and load current power factors equal.

It is important to appreciate this point fully as confusion can arise with respect to other devices where different conditions prevail. It should be noted that while the basic theory has been developed ignoring internal impedance drops and magnetising current effects, this does not affect the principle and it is easy to see how the voltage and current vector diagrams are slightly modified by these additional quantities.

Fig. 4 shows, again for the ideal single induction regulator having an output voltage equal to line voltage, the characteristic output voltage, as a percentage of the maximum, over its range of effective displacement angle which is 0-180° for a two-pole machine, both electrically and mechanically. The characteristic curve has the relationship:—

$$V_0 = 2\,V_L \cos\frac{\alpha}{2}$$

Apart from the top end of the output range, therefore, the voltage variation is substantially linear with displacement angle, a point which is of some importance with automatic control systems. Fig. 5 shows, on the same basis of percentage maximum output voltage V_O, the change in the output power which is also, of course, the input power, and this relationship has the form:—

$$W_O = 12\,\frac{V_L^2}{R}\cos^2\frac{\alpha}{2}$$

Transferring W_O, the percentage kilowatt output, on to a displacement angle basis, Fig. 6 is obtained, which is substantially linear over the central part of the displacement range.

The curves in Figs. 4 to 6 give a good idea of the external performance characteristic of the system, but it will be seen that similar characteristics apply to other equivalent arrangements and particularly to variable loads and loads of any power factor. Fig. 4 is therefore generally relevant, apart from internal voltage drops, but is modified by the turns ratio of the induction regulator, i.e. the overall control range used.

To summarise, the single induction regulator in buck-boost connection is the simplest voltage arrangement and, although it produces a variable phase variable output voltage, it does not introduce any phase shift in the effective line current other than that introduced by the power factor of the load. The "ideal" machine is simply described by basic characteristic curves and output equations, to which can be added the normal impedance voltage drop and magnetising current effect equivalent to that of a simple transformer, all calculations being made with respect to the line. Being a true variable voltage device, the induction regulator is suitable for a variable load, the load only affecting the relatively small internal voltage drop.

The Saturable Choke

It is interesting to compare the simple ideal saturable choke arrangement shown in Fig. 7a with the performance obtained from an induction regulator. Here again, all quantities are treated without considering internal voltage drops or magnetising effects so that the voltage vector diagram will be as shown in Fig. 7b and the current vector diagram as shown in Fig. 7c where a resistive load is stipulated.

For the constant resistance load stipulated, the voltage vector diagram is the semi-circle indicated in Fig. 7b, as the choke voltage V_C is always at right-angles to the output

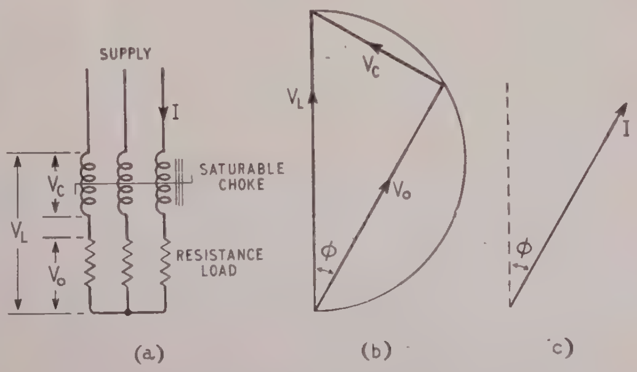

Fig. 7.—Saturable choke control with resistance load

(a) Connection diagram
(b) Voltage vector diagram (one phase only shown)
(c) Current vector diagram (one phase only shown)

load voltage V_O, the two voltages adding up vectorially to the line voltage V_L. The output current I is in phase with the output voltage V_O and is assumed to subtend an angle ϕ with the line voltage V_L.

The load current I, which also flows in the supply line, has a reactive component which is dictated by the magnitude of the saturable choke voltage and therefore of the output voltage. This in fact is the kVAr or wattless load taken by the saturable choke for voltage control purposes.

Fig. 8 shows, on a percentage output voltage basis, the ratio of the saturable choke reactance x to the fixed resistance load R for a practical range of output. It is obvious that to obtain a very low output voltage, a very high reactance is required which would mean in practice either a very high minimum to maximum reactance ratio, which is difficult to obtain, or a relatively high fixed minimum reactance which produces initially a high kVAr load in the system. Fig. 8 also represents the ratio of input kVAr (Q_i) to output (or input) kW (W_O) for a given setting of the choke saturation and therefore the output voltage. The characteristic relationship is

$$V_O = V_L \cos \phi$$

$$\frac{x}{R} = \tan \phi = \frac{Qi}{W_O}$$

The output power (W_O) on a basis of output voltage (V_O) is shown in Fig. 9 where the input kVAr (Q_i) is also drawn as a percentage of the maximum kW output. It will be seen, as is clear from inspection of the vector diagram, Fig. 7b, that at half kW output, i.e. 71 per cent voltage, the output kW equals the input kVAr. It is interesting to note that over the range of 80-40 per cent output kW, the kVAr demand lies between 40 and 50 per cent of the maximum kW input, i.e. over the normal operating range there is a relatively high kVAr demand.

The relationship appertaining to these curves is

$$W_O = 3 \frac{V_L^2}{R} \cos^2 \phi$$

$$Qi = \frac{3}{2} \frac{V_L^2}{R} \sin 2\phi$$

As the output voltage $V_O = V_L \cos \phi$, the scale of output voltage can also be read as power factor of the system for a given kW output. On half output, therefore, the power factor is 0·71, which is, of course, implied by the equality of the kVAr and kW input.

Fig. 10 shows, on a basis of reactance to resistance ratio, the kW output, from which it will be seen that there is a relatively linear relationship between two quantities down to about quarter load after which a very large change of controlled reactance is required to produce a small change of output. This obviously entails additional difficulties when referred to automatic control systems. Fig. 10 also shows the kVAr to kW ratio for any output.

To summarise, the saturable choke, being a variable impedance device, relies on a relatively large kVAr demand from the line for obtaining an output variation. It is therefore basically limited with regard to type and variation of load and range of control, as well as producing subsidiary effects such as harmonic distortion.

Double Induction Regulator

Before continuing with the more general consideration of the use of induction regulators, quite irrespective of the internal connection diagram, it is worth while to consider briefly a common arrangement derived from two single induction regulators coupled mechanically and electrically, constituting a "double induction regulator." By arranging the windings and output voltage vectors as shown in Figs. 11a and 11b, a constant phase variable voltage device is obtained with a reversible output with respect to the line voltage phase position.

The characteristics are similar to those of the single induction regulator in buck-boost connection, apart from the fact that no phase shift of the output voltage is obtained. Although two cores are used and therefore more windings, the number of flexible connections remains the same by connecting the primary windings in parallel internally and bringing out three leads only, the six-terminal secondary windings being normally placed on the stator.

Regulator/Transformer Combinations

It is not always possible to obtain the correct output voltage range by direct application of a single induction regulator in buck-boost connection to the line. In many cases the voltage level would be incorrect and the utilisation of the induction regulator is often uneconomical in the sense that it cannot be used over its full bucking and boosting range due to limitations of minimum or maximum

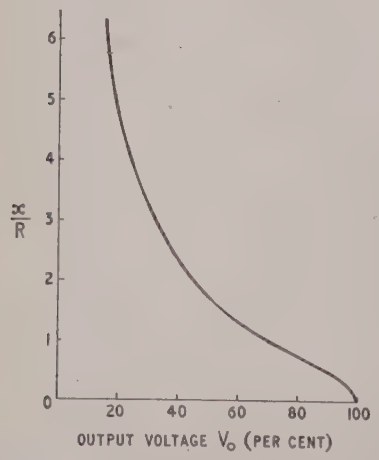

Fig. 8.—Output voltage characteristic with resistance/reactance and kVAr demand/kW output ratio of saturable choke system of Fig. 7

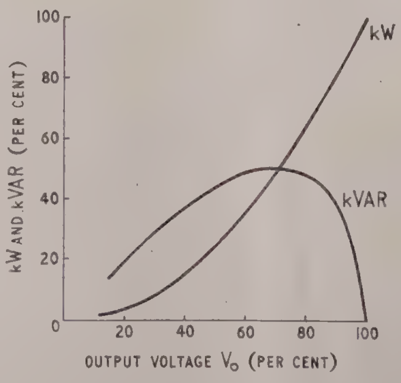

Fig. 9.—kW output and kVAr demand characteristic with output voltage and power factor of saturable choke system of Fig. 7

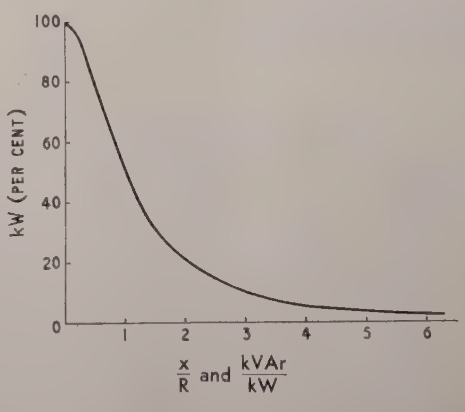

Fig. 10.—kW output characteristic with impedance and kVAr demand/kW output ratio of saturable choke system of Fig. 7

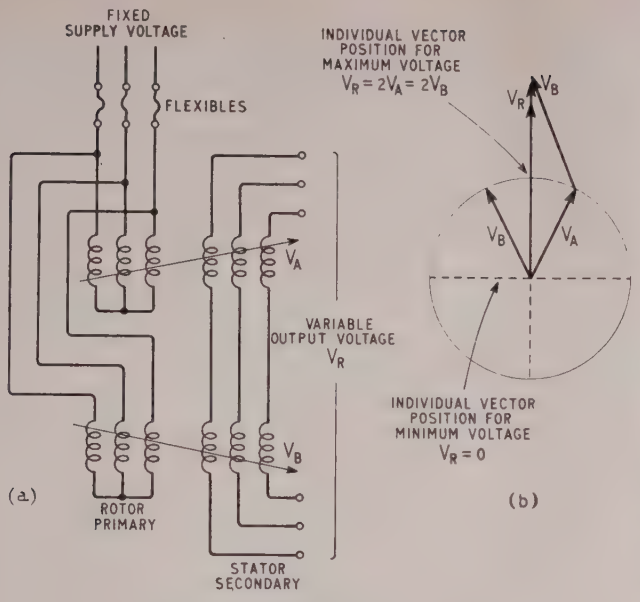
FIXED SUPPLY VOLTAGE
FLEXIBLES
INDIVIDUAL VECTOR POSITION FOR MAXIMUM VOLTAGE $V_R = 2V_A = 2V_B$
V_R
V_B
V_A
V_B
V_A
VARIABLE OUTPUT VOLTAGE V_R
V_A
V_B
INDIVIDUAL VECTOR POSITION FOR MINIMUM VOLTAGE $V_R = 0$
(a)
ROTOR PRIMARY
(b)
STATOR SECONDARY

Fig. 11.—The double induction regulator

(a) Connection diagram
(b) Voltage vector diagram (one phase only shown)

voltage. Consequently, it is usual to combine the induction regulator with a transformer in such a way that the regulator can be utilised fully and the correct load voltage level obtained.

Six common arrangements will now be discussed and these are tabulated in Fig. 12. While this list is by no means exhaustive, it is typical and indicative of the design considerations which must be made to obtain the best overall result.

On each figure is shown a single-phase connection and voltage vector diagram and the following quantities are stated:—

(a) The maximum voltage V_{max} in terms of the supply voltage V_L and the ratio K of maximum to minimum output voltage (i.e. the voltage range).

(b) The nominal induction regulator kVA rating R as a proportion of the maximum system kVA output L.

(c) The nominal transformer kVA rating T as a proportion of the maximum system kVA output L (where a transformer is used).

Fig. 12a shows a buck-boost single induction regulator in " auto-transformer " connection. Here the dependence of the rating of the induction regulator in terms of the output voltage range is of particular interest. It should be noted in this connection that in a normal low-voltage network a maximum voltage of 550-600 V only is permitted so that normally a 3 : 1 (K=3) voltage range is a limiting feature of this simple connection, if the induction regulator is to be fully utilised. There is, of course, little loss of output if the top end of the voltage range is limited to the maximum permitted voltage, while using the full range of the induction regulator at the low-voltage end.

This is the simplest and cheapest arrangement that can be produced. If the load requires a very low or very high voltage compared with the normal winding possibilities of the size of induction regulator under consideration, the induction regulator can be placed in the primary of a transformer, the secondary of which gives the correct output voltage level. The single induction regulator has been shown to give a 3 : 1 (K=3) voltage variation on the voltage vector diagram resulting in a rating of one-third of the maximum output load. Common applications include line voltage regulators and heater controls.

If the maximum voltage cannot be raised above the normal voltage of the system, in exceptional cases a bucking regulator is used, i.e. the regulator is only utilised to half its maximum capability (Fig. 12b). While the more normal connection is that discussed in the next paragraph, there may be special reasons for using this arrangement, so it is included for the sake of completeness. This arrangement has only a small voltage range (2 : 1, i.e. K=2) so it can be used in the upward direction to counteract line voltage drops and supply regulation only.

In Fig. 12c is shown an arrangement giving a free choice of output voltage range by utilising a centralising transformer in such a way that the induction regulator voltage variation covers exactly the required voltage range. This again represents economical arrangements in all respects and is frequently used for this reason. The induction regulator and transformer sizes are, of course, minimised

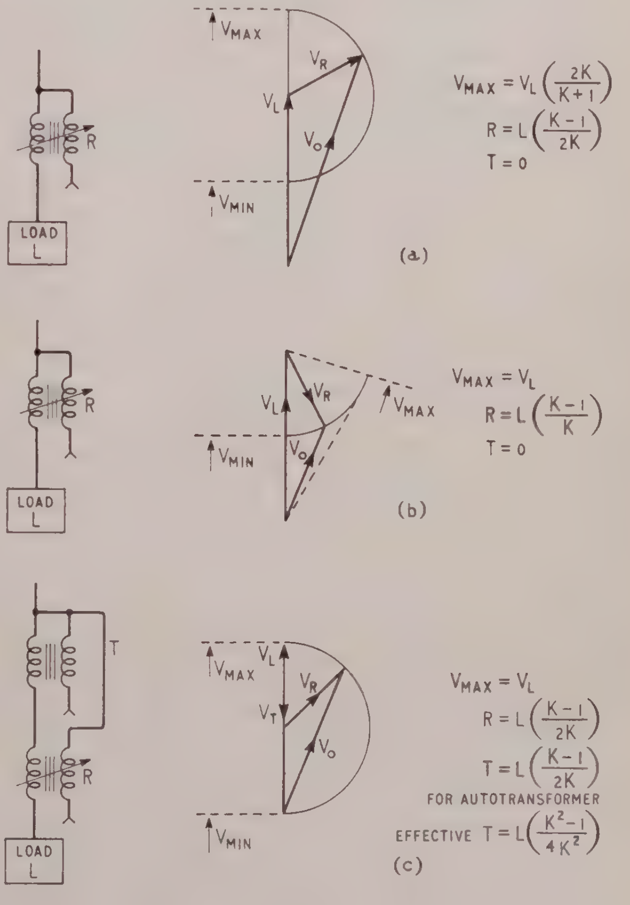
V_{MAX}
V_R
V_L
V_o
V_{MIN}
R
LOAD L
$V_{MAX} = V_L\left(\frac{2K}{K+1}\right)$
$R = L\left(\frac{K-1}{2K}\right)$
$T = 0$
(a)
V_L
V_R
V_{MAX}
V_{MIN}
V_o
R
LOAD L
$V_{MAX} = V_L$
$R = L\left(\frac{K-1}{K}\right)$
$T = 0$
(b)
T
V_{MAX}
V_L
V_R
V_T
V_o
V_{MIN}
R
LOAD L
$V_{MAX} = V_L$
$R = L\left(\frac{K-1}{2K}\right)$
$T = L\left(\frac{K-1}{2K}\right)$
FOR AUTOTRANSFORMER
EFFECTIVE $T = L\left(\frac{K^2-1}{4K^2}\right)$
(c)

Fig. 12.—Typical single induction regulator/transformer combinations

L—Load kVA rating
R—Induction regulator kVA rating
T—Transformer kVA rating
K—Voltage ratio $V_{max.}/V_{min.}$

(a) The buck-boost single induction regulator in auto-transformer connection

(b) The bucking single induction regulator in auto-transformer connection

(c) The buck-boost induction regulator with centralising transformer in auto-transformer connection

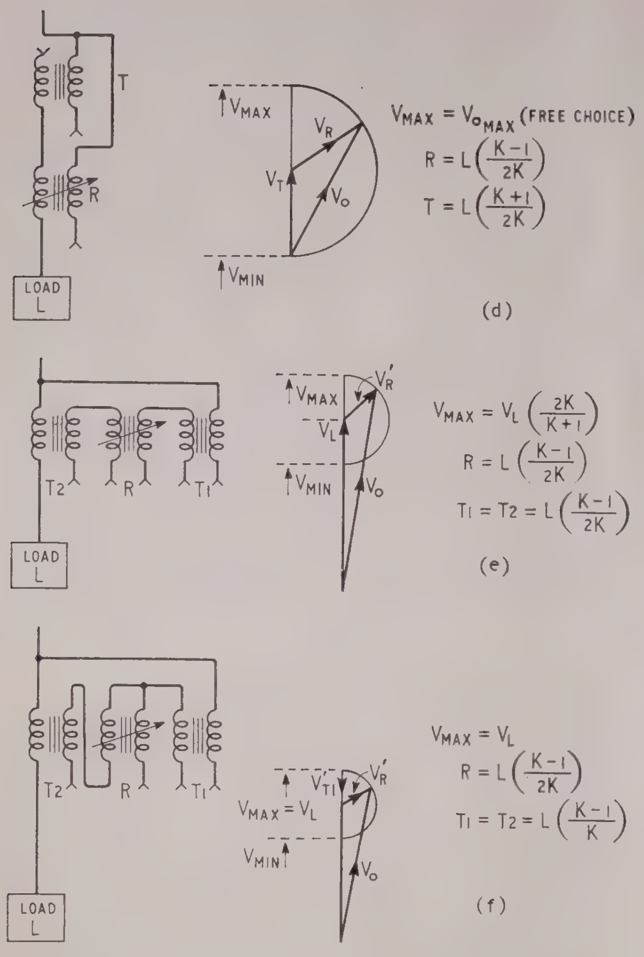

Fig. 12.—(continued)

(d) The buck-boost single induction regulator with centralising transformer in dual-wound connection

(e) The buck-boost single induction regulator with primary and secondary transformers

(f) The buck-boost single induction regulator with primary centralising and secondary transformers

by this arrangement. The transformer can be an auto-transformer to minimise its size and cost.

As a typical example (shown on the voltage vector diagram) for a voltage regulator to operate from full line voltage to approximately zero ($K>10$), each unit is rated at half the maximum rating of the load. Moreover, with suitable tappings on the transformer it is practicable to obtain an output voltage very near to zero, which is of importance in some cases.

Fig. 12d is similar to Fig. 12c, except that the secondary windings are no longer connected to the supply, but are separated from the line. This entails a higher rating for the centralising transformer which, with a nominal voltage range of 10 : 1 ($K=10$), amounts to only 10 per cent, and with a 3 : 1 ($K=3$) voltage range, to 33 per cent, compared with the arrangement of Fig. 12c. This arrangement is obviously useful for equipment feeding a low-voltage load from a high-voltage supply.

Fig. 12e shows an arrangement which is used where relatively small voltage ranges are required and the equipment operates on a high-voltage supply which is either uneconomical or even impracticable for the primary winding of the induction regulator. In these cases, a normal buck-boost arrangement with two transformers is used, as shown in Fig. 12e for a ±25 per cent voltage range ($K=1{\cdot}67$). This arrangement minimises the ratings of the induction regulator and the two transformers, their ratings being 20 per cent of the maximum output in the example illustrated.

If the maximum permissible voltage of the arrangement of Fig. 12e is limited to the line voltage, a similar arrangement with two transformers as shown in Fig. 12f can be used. The centralising effect is obtained by an auto-transformer connection on the induction regulator supply transformer. This results in doubling the rating of both transformers compared with the arrangement of Fig. 12e, while the induction regulator rating remains the same and at the minimum. This particular example shows clearly the effect of system design in the economical solution of a particular problem.

Substituting a double induction regulator in any of the above arrangements has no effect whatsoever, apart, of course, from obtaining a fixed phase for the output voltage. It is always possible to use a double induction regulator by itself for voltage variation, as the device has inherently a variable voltage output, but the utilisation is uneconomical unless a centralising transformer is used in line with, for instance, Figs. 12c or 12d.

It will be seen from the above examples that a large number of combinations are possible to obtain a required result. Each case has, of course, to be considered on its merits, but in general it should be noted that the best arrangement to be used in conjunction with an induction regulator will normally not be the best arrangement to be used in conjunction with, for instance, a saturable choke, and vice versa, as the intrinsic capabilities of the devices differ widely.

Conclusion

The single induction regulator, being a true variable voltage device, lends itself readily to economical arrangements of voltage control systems for fixed or variable loads regardless of power factor, the load having only the secondary effect of altering the small internal voltage drop. No undesirable side effects are present with these machines, which are made in line with rotating machine practice for low- and high-voltage inputs appropriate to the size, which goes up to some 5,000 kVA.

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DIP.TECH. COURSES

THE 1960-61 report of the National Council for Technological Awards, published recently, states that nearly 5,000 students were taking courses in the Diploma in Technology compared with 3,800 a year before; nearly 1,770 students, including 63 women, had enrolled in first-year courses compared with 1,500 in 1959-60, of whom 40 were women; over 470 Diplomas had been awarded; and 34 applications had been received for the M.C.T. (Membership of the College of Technologists), of which 27 had been accepted and five were under consideration.

VIEWS on the NEWS

By "REFLECTOR"

MERIT and remuneration should go hand in hand, but too often merit is equated with virtue and is regarded as self-rewarding. In pursuing its aim to raise the status of its members, the Electrical Power Engineers' Association places considerable emphasis upon education and has set up technical groups throughout the country. These groups have a total membership of over 4,000 and they discuss a great variety of subjects. The dual object is well stated in the current issue of the *Electrical Power Engineer* in the following terms:—

> "Although the E.P.E.A. is first and foremost a practical trade union, at the same time it has always taken the view that the giving of value for money in standards of professional competence is not only essential to our reputation as staff engineers but is a powerful aid in negotiating the best possible standards of remuneration. Properly understood there is no clash or rivalry between the educational work of the E.P.E.A. and our efforts in the salaries field. The two are inter-dependent or complementary."

* * *

The July issue of the *Electrical Power Engineer* also mentions the Association's search for a new headquarters since the present premises in St. George's Square, Westminster, have become excessively congested. Other sites in London are far too expensive and so a special committee appointed to deal with the matter has looked further afield and has found a vacant country house in Surrey, already converted to office use, and the National Executive Council has authorised its General Purposes Committee to proceed "subject to the usual safeguards." In this the Council has set a good example to other concerns which could quite reasonably keep clear of the Metropolis and its inflated values.

* * *

A little while ago I suggested that a transatlantic power cable would be even more advantageous than the one between England and France which will soon be put into service because of the very great time difference. The distance between the east and west coasts of the United States is greater than that separating this country from America and the corresponding time difference is consequently sufficient to result in wide variation of the load across the continent in any given period. I return to the subject after reading an article in the *Economist* touching upon certain aspects of the American power supply system. With the advent of the new administration the question of public *versus* private undertakings has again come into prominence. Under the Eisenhower régime it had somewhat fallen into the background. Now there is a suggestion that surplus power from the Federal hydro-electric schemes on the Columbia River should be transmitted to central and southern California. An official of the private companies has said that this transmission would "almost surely become the first link in a coast-to-coast federal grid tying in all the regional [public] power systems." The *Economist's* correspondent thinks that this would make "economic sense" and goes on to visualise the transmission of electricity to the south in summer for air conditioning and to the north in winter for heating. But I wasn't serious in putting forward my transatlantic cable suggestion.

* * *

It must have been quite a day in the history of Newton Abbot when the local power station was opened to the public for, says a *Mid-Devon Times* reporter, the station has been a "closed book" to most local people. He records that the tour started at the cooling tower,

> "a town landmark, nearly 200 feet high, where 1,500,000 gallons of water are cooled hourly for conversion into steam and the heat needed to power the turbines."

I know that cooling tower, as I suppose many of my readers do. It is a gaunt structure of proportions strange to the modern eye; although it was actually erected in 1924 it seems to me to have a Victorian air. If it were to be demolished it would be badly missed by travellers to Torquay to whom it is a sign that they are nearing their journey's end.

* * *

Eighty years ago there was an extraordinary general meeting of the Electric Light & Power Generator Co. As reported in the *Electrical Review* of 1st August, 1881, Admiral Sir Edward Inglefield, the chairman, said that, in distributing electricity in the Queen Victoria Street area,

> "they had the advantage of having several distinct cables, in case one portion should not be as successful as the other; in fact they had four distinct cables, so that, for instance, if they should find that evening that one portion did not work well they could still go on working with the other three without the fourth. Accidents might happen, a cab running against one of the lamp posts would break the contact for a time, but by having three other cables to work with there need be no apprehension on the part of either the shareholders, however anxious they might feel, or of the public, that there could be any serious breakdown even should any unforeseen accident occur."

In answer to a shareholder's question a Mr. Crookes (presumably an engineer) said that "through a good cable 75 per cent of the power could be carried to a very distant part."

Caniçada Dam on the Cavado River

Electricity in PORTUGAL

By DIANA ANLEY

Hydro-electric plant forms the bulk of the generating capacity of the electricity supply industry in Portugal and this article surveys the more important schemes in operation and under construction

ONE of our oldest friends and allies and now a fellow member of the "Outer Seven," Portugal has found that her increase in demand for electricity is well above the average annual figures of other countries. For example, during the period 1950-59, the maximum demand rose from 942 million to 2,988 million kWh (provisional value). Owing to the scarcity of solid and liquid fuels, this increase must be met by hydraulic resources, with thermal power (using poor national fuel) acting only as a reserve in times of damage or drought.

Hydro-electric power potential is considerable, but at the required rate of exploitation it will be exhausted by 1975. Unfortunately, there are few storage schemes and rainfall is irregular and varies from year to year. Rivers are torrential during the wet season, but become dry in summer and sometimes this lasts well into the autumn. When this dry period occurs, thermal power must be used to help meet the national demand. Bearing in mind the heavy overhead charges in cases of limited utilisation, it is advisable that this form of power should be just sufficient to act as a support when needed.

There are deposits of uranium ores in the country and serious studies are being made of nuclear production. It is hoped, therefore, that by the end of 1975, internal industry will have developed sufficiently to supply the plant and material needed for this form of energy.

It might be as well to mention two interesting points from the "National Electrification Law, 2,002," passed in December, 1944, which establish the following principles: (a) The Government has to promote the installation of large generating plants and the State may have a share in the capital of the new companies, helping these undertakings, as well as transmission and distribution lines, and substations, by means of loans; and (b) the Government will take part in the settling of tariffs concerning sales to consumers. As a result of this law, new hydro-electric power and transmission installations were put into commission in 1951 and private companies were formed in whose capital the State had a share, together with pre-existing companies and the general public.

Permanent co-ordination of electric power production on a national basis is assured by a special body called the National Load Dispatching Board (Repartidor Nacional de Cargas). Through this Board an active part is taken by all the companies which belong to the interconnected electricity system. Its executive body is formed by representatives of the companies, with the State representative as president. As the function of the Board is essentially technical, economical and financial agreements in the form of "Power Pools" have been carried out between the companies. This means that charges and profits are, as a rule, divided beforehand according to conveniently established proportions.

Transmission of power generated by the companies is

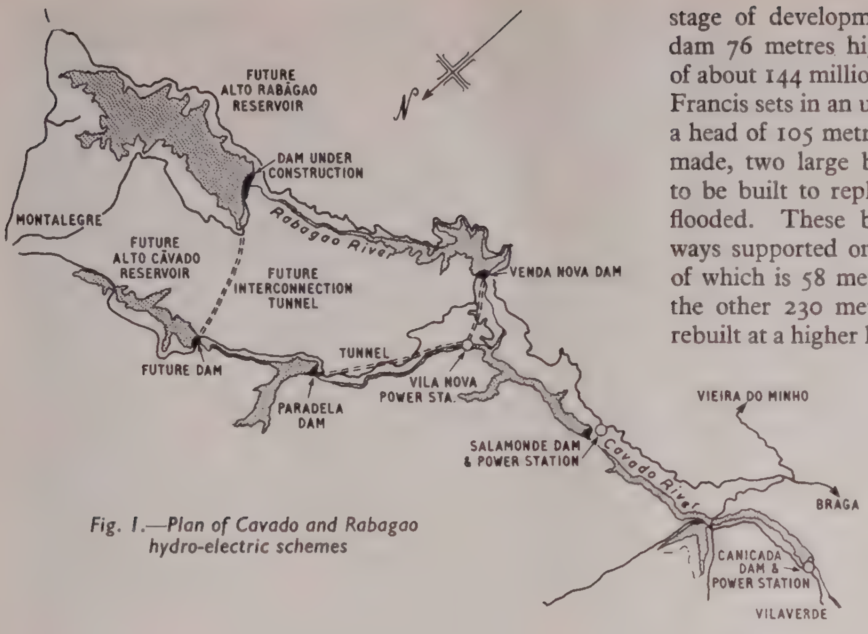


Fig. 1.—Plan of Cavado and Rabagao hydro-electric schemes

in the hands of the Companhia Nacional de Electricidade which interconnects all supplies and acts as a national grid. There are also several large distributing companies which existed before the passing of Law 2,002 and some of these have their own hydro-electric and thermal power stations.

Some of the companies which came into existence as a result of the Law are the Hidro-Electrica do Zezere, which was set up in 1945, the Hidro-Electrica do Cavado in 1946 and the Hidro-Electrica do Douro in 1954. It is chiefly in the northern mountainous regions that extensive development is taking place, although there are several large schemes in other parts of the country.

Cavado Schemes

The Hidro-Electrica do Cavado was formed to develop the catchment areas of the Cavado and its main tributary, the Rabagao (Fig. 1). The Cavado River is 62 km long and rises in the mountains near Montalegre, flowing into the Atlantic Ocean. Siting of the various dams was fairly simple owing to its descent in a series of natural declivities. The first dam was built across the River Rabagao at Venda Nova (Fig. 2). It is an arched gravity dam 97 metres high with a useful storage capacity of about 95 million cu metres. The reservoir supplies three 30 MVA horizontal shaft, single-jet, Pelton turbines, under an average net head of 395 metres, in Vila Nova power station. This station was brought into service in 1951 and is situated on the left bank of the Cavado, above the confluence of the two rivers. It is interesting to note that the turbines, valves and switchgear were supplied by the English Electric Co., Ltd., and the generators by the Metropolitan-Vickers Electrical Co., Ltd. Because of restricted space, the main switchgear was placed on the roof of the power station.

Construction of the second dam was at Salamonde, with an underground power station, which came into use in 1953 (Fig. 3). This is a thin arch dam, 75 metres high, spanning the Cavado River downstream from Vila Nova. The useful storage capacity of the reservoir is about 57 million cu metres and it supplies two 25 MVA Francis turbines under an average head of 114 metres.

Further downstream the Caniçada Dam forms the lowest stage of development in this area. This is a thin arch dam 76 metres high, providing a useful storage capacity of about 144 million cu metres which supplies two 32 MVA Francis sets in an underground power house (Fig. 4), under a head of 105 metres. Before Caniçada reservoir could be made, two large bridges carrying national roadways had to be built to replace existing ones across the area to be flooded. These bridges have reinforced concrete roadways supported on hollow pillars of masonry, the highest of which is 58 metres. One road is 206 metres long and the other 230 metres. An entire village also had to be rebuilt at a higher level on the hillside.

Returning to the upstream portion of the catchment area, the fourth dam is sited at Paradela, just below the confluence of the Cavado River with another of its tributaries, the Pisoes. Paradela Dam, 112 metres high, with a crest length of 532 metres, is said to be the highest rockfill dam in the world. Geological investigations revealed that the terrain was not suitable for a concrete structure. It was decided that as there was an excellent supply of granite at a distance of 2 km from the chosen site, a quarry would be opened up and a road constructed. This road was necessary for the transportation of the granite by heavy vehicles. An interesting technical point about the dam is that it was constructed in three stages, so that, in the first stage, an additional run-of-river set could be put into service in Vila Nova power station. Two rockfill embankments were also needed to seal off the necessary storage area and the well-type spillway was so designed that it could function at all three stages. As an extra precaution, an emergency spillway has been made with a controlled section gate and this discharges through a bottom tunnel about 300 metres long into the bed of a small nearby tributary.

The supply tunnel from Paradela Dam to Vila Nova station is about 11 km long and includes a length of steel pipeline supported on concrete trestles. This is carried across a valley in the open for about 660 metres. The final length of 60 metres is laid alongside the Venda Nova penstock, before they both enter the power station.

It was originally intended that Paradela reservoir should

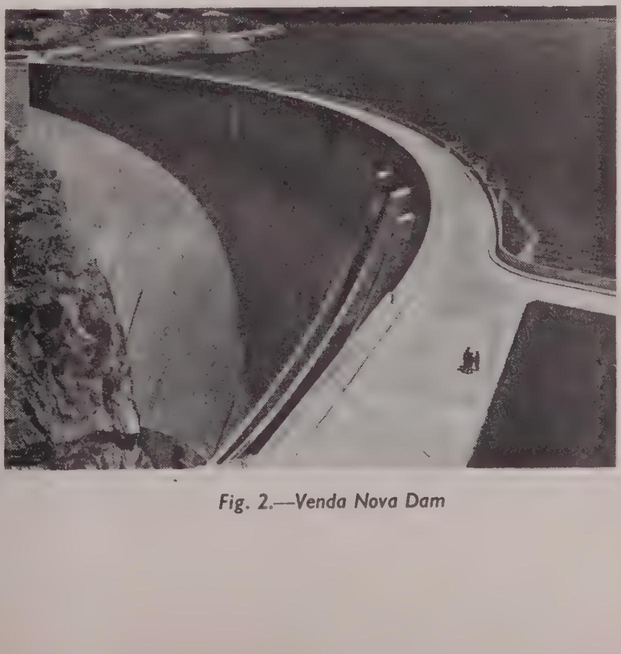


Fig. 2.—Venda Nova Dam

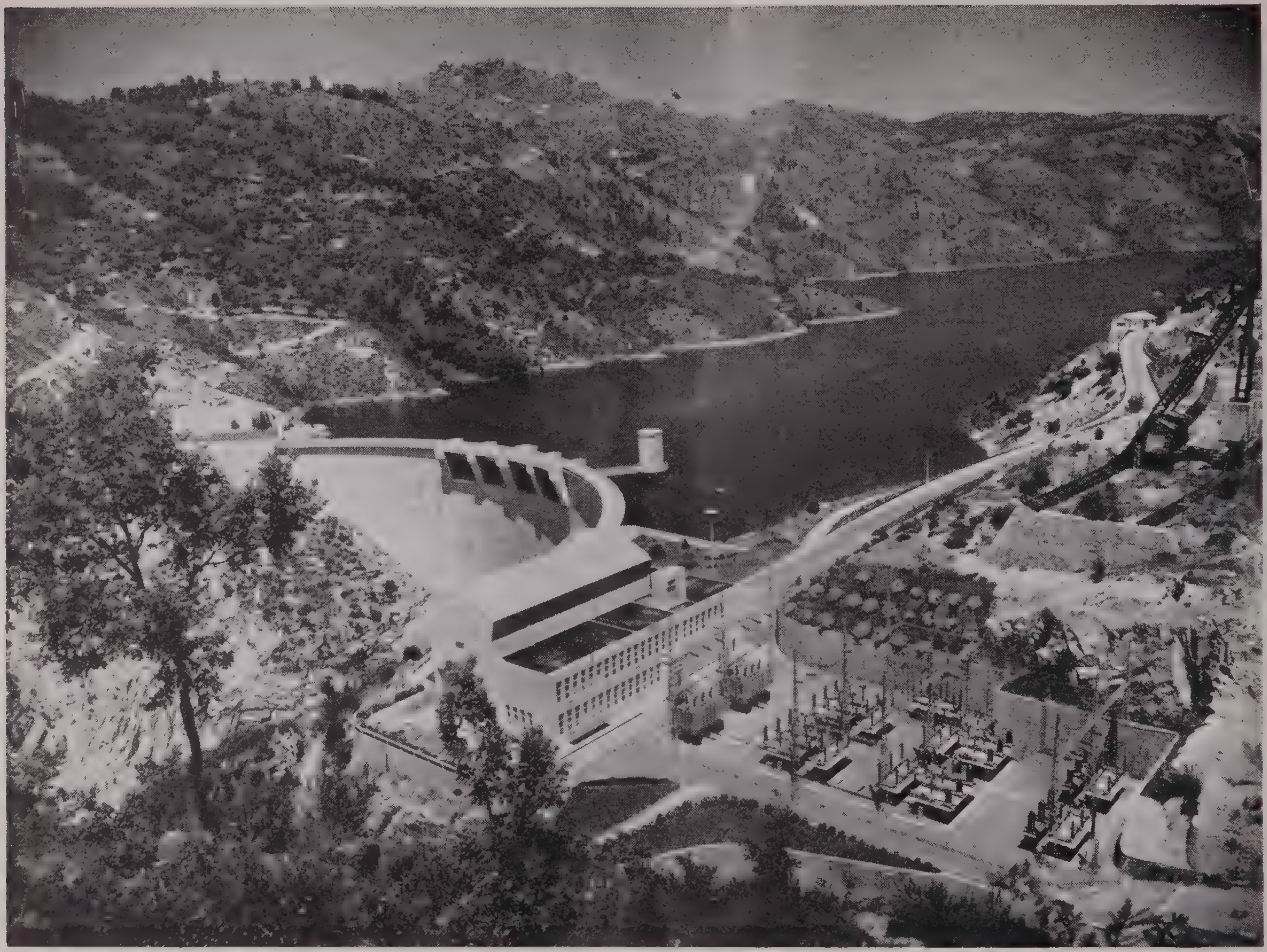
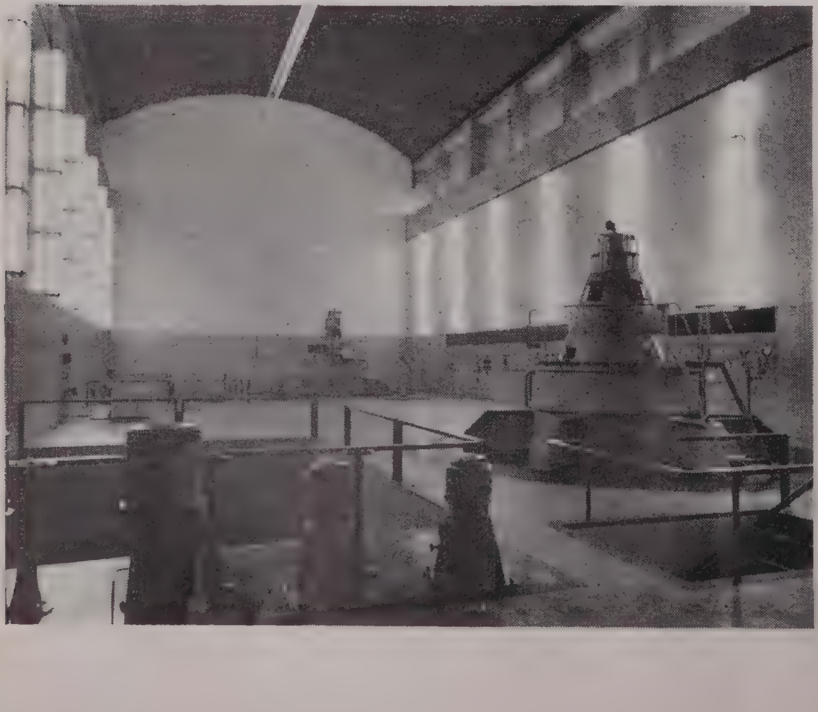


Fig. 3.—Salamonde Dam and power station

supply a fourth 30 MVA Pelton set, but in view of the technical advances which have been made in the design and uses of Francis turbines under increasingly high heads, it was decided to install a 60 MVA Francis set.

Fig. 4.—Caniçada power station



This decision involved necessary structural alterations which posed many problems in a station that was already in operation. Considerable reinforcement of the existing building (where space was extremely limited) had to be carried out before the new set could be installed and the necessary adaptations made for the draught tube and tailrace at a lower level (Fig. 5). The Francis set operates under a head of 440 metres, the turbine being supplied by Ateliers des Charmilles and the alternator by Brown-Boveri & Co. Within the station, the two penstocks having been placed side by side; No. 3 Pelton set, by means of a special valve, can operate on water taken either from Venda Nova or Paradela reservoirs.

The final dam, known as the Pisoes scheme, is now being constructed on the Alto Rabagao. It will have an arch dam 103 metres high with a remarkable crest length of 2¼ km. The work will also include about 27 km of new roadway to replace the old one which will be flooded. On the Alto Cavado there will be a secondary dam 28 metres high and a tunnel will connect the two reservoirs. The Alto Rabagao reservoir, with annual regulation, will supply two 40 MVA sets in an underground power house, with a maximum head of 193 metres, and will discharge into Venda Nova reservoir. It is also planned to include pumped storage in the scheme and it is hoped that the entire plant will go into service during 1964.

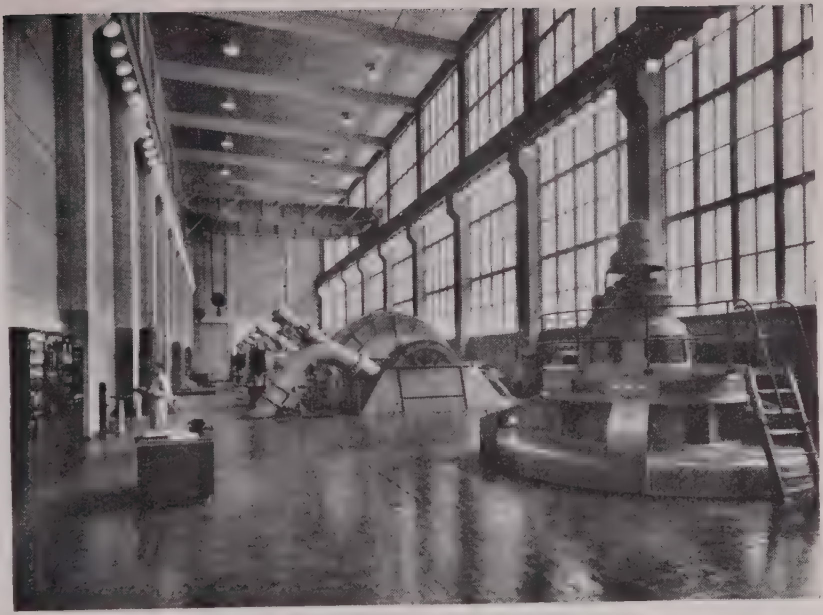


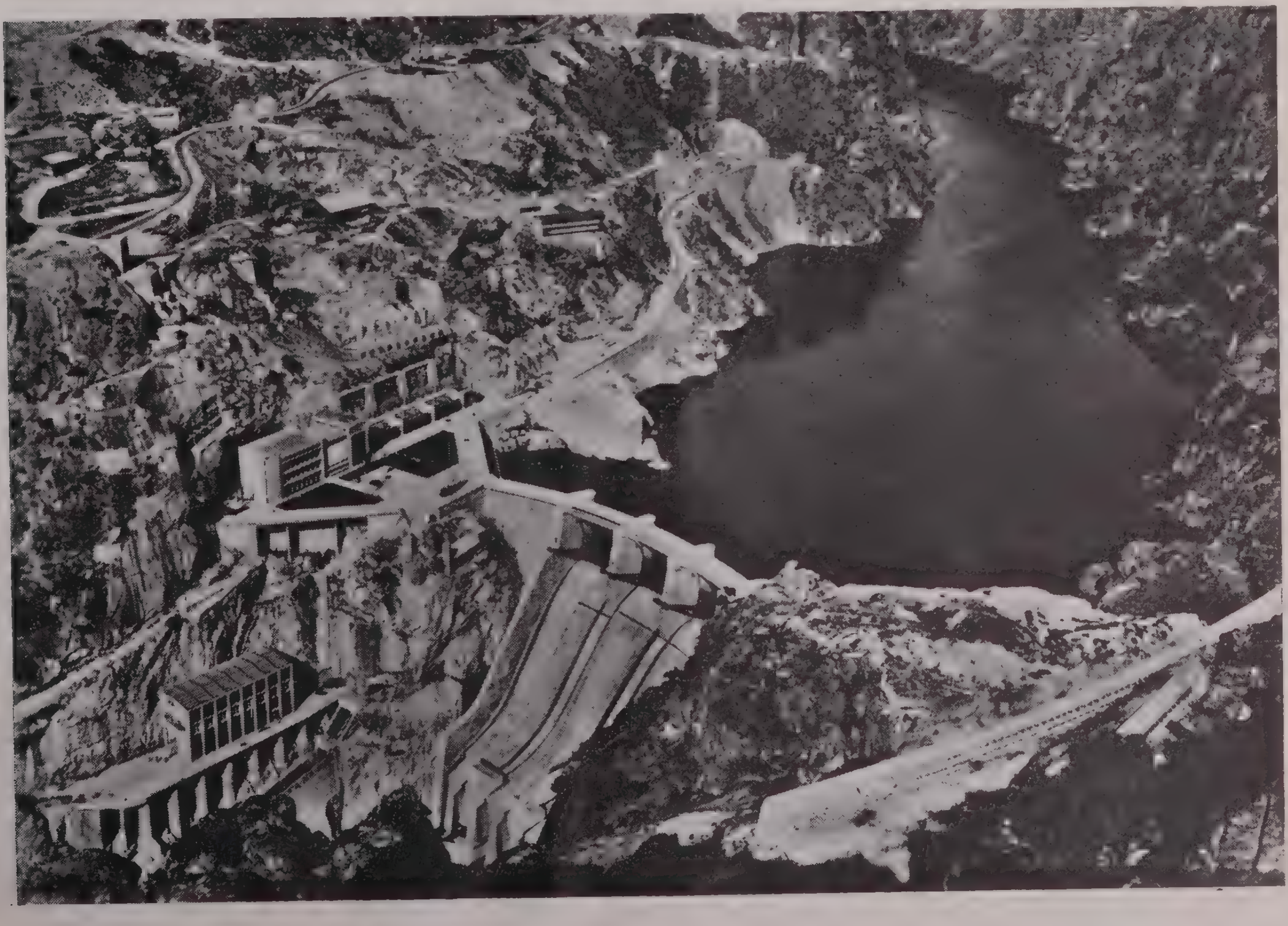
Fig. 5.—Vila Nova power station with Francis turbine in the foreground

Douro Schemes

The development schemes being undertaken by the Hidro-Electrica do Douro lie in the international zone of the River Douro and have been planned according to the agreement of 1927, which determined that the utilisation of the total head concerned Portugal and Spain separately and in some parts approximately equal. The upstream part of the zone belongs to Portugal and the downstream to Spain. Thus, a fall of about 400 metres, which lies in that part of the Douro serving as a border between the two countries, was divided, the Portuguese developing three sections and the Spanish two.

The first Portuguese section to be developed is at Picote and is a run-of-river plant with weekly regulation. It has an arch dam, 100 metres high, with four spillways and the useful capacity of its reservoir is about 13 million cu metres. Under an average net head of 71 metres, it provides the water for three 93,000 h.p. Francis turbines with a speed of 166 r.p.m. in the underground power station (Figs. 6 and 7). Average annual production is about 1,000 million kWh. It came into service in November, 1958, and was opened by the President of the Republic of Portugal. The power station, which is

Fig. 6.—Picote Dam, control room and substation on left (taken from the Spanish side)



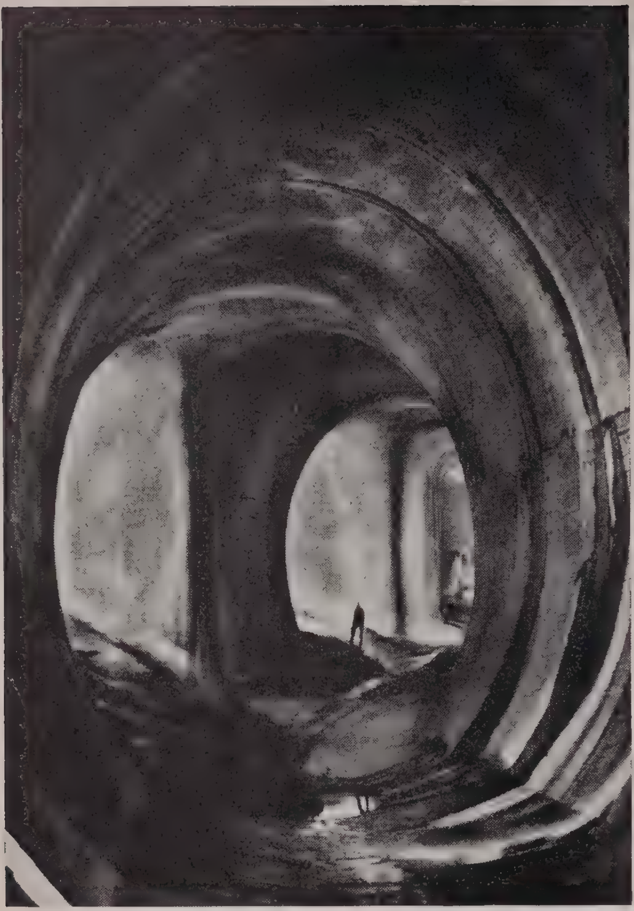


Fig. 7 (above).—Picote tailrace tunnel from which the three draught tubes emerge

Fig. 8 (right).—Picote underground power station

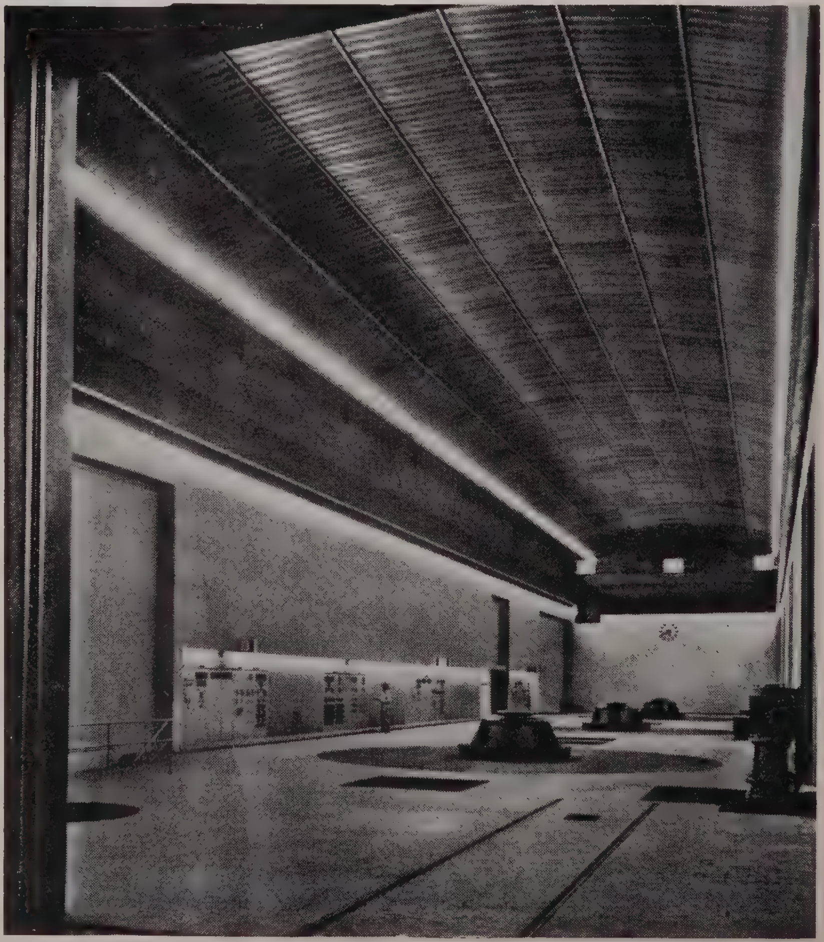
excavated in the granite mountain side, is 88 metres long, 16·6 metres wide, 35 metres high and it has considerable automatic control features (Fig. 8). It has two lift shafts at opposite ends, one 35 metres deep which allows machinery, etc., to be lowered into the station and another 78 metres deep, giving access from the station to the control room buildings. The 15 kV busbars are carried up the side of this latter shaft and the substation is on a platform at the side of the control room edifice. Here, the voltage is stepped up to 220kV to be fed into the national grid. There are two overhead 220 kV lines, one to Oporto and the other (which has just come into service) to a transformer station at Coimbra and thence in the future on to Lisbon. Erecting some parts of these lines was difficult owing to the contours of the country to be traversed. There is also a 30 kV line which provides for local consumption.

The second section of the international zone is at Miranda and is under construction, having practically the same characteristics as Picote. It will be a run-of-river plant with a massive head buttress dam, 80 metres high, and the useful capacity of the reservoir will be six million cu metres. Under an average net head of 56 metres, power will be provided by three 60 MVA vertical shaft 80,000 h.p. Francis turbines with an average speed of 150 r.p.m. in an underground power station. It is hoped that this scheme will start operating this year, but work was held up for seven months in the winter and early spring owing to extreme flooding of the river. To speed the excavation of the power station, a side shaft was sunk so that it was possible to work upwards as well as downwards. It is hoped that average annual production will be in the region of 820 million kWh. The third section of the zone will be at Bemposta, a run-of-river plant with a gravity arch dam 85 metres high and the useful water capacity of its reservoir will be about 31 million cu metres. It will supply three 78 MVA sets under an average head of 67 metres and annual production will be about 955 million kWh. The scheme will probably come into service in 1965 and supply power to Coimbra and Lisbon.

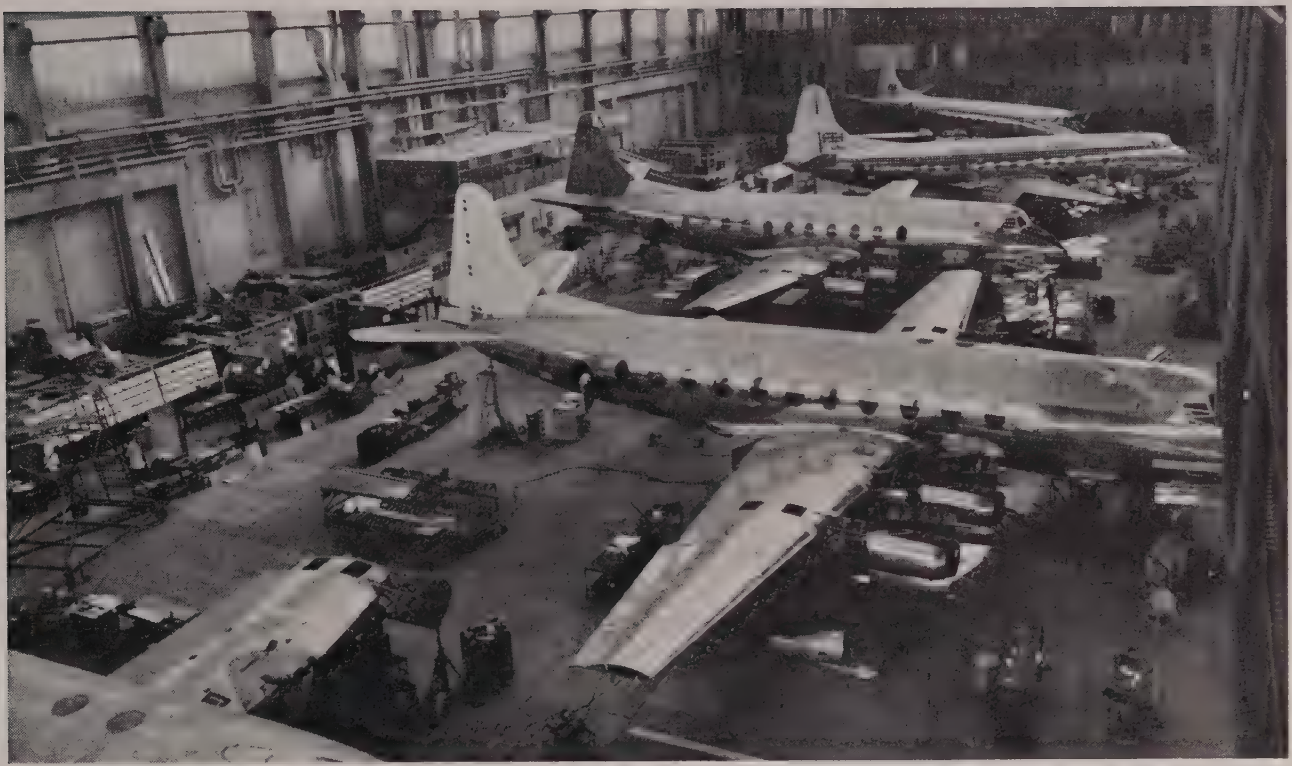
To keep pace with this development, the Companhia Nacional de Electricidade has constructed new transmission and interconnection lines at 220 kV and 150 kV.

An item of special interest is the interconnection of the Portuguese and Spanish systems at 220 kV through a switchyard at Pochina which will soon be brought into commission.

The illustrations are reproduced by courtesy of Hidro Electrica do Cavado, Hidro Electrica do Douro and Companhia Nacional de Electricidade.



B.E.A. Engineering Base at London Airport



Aircraft maintenance in the second B.E.A. engineering base at London Airport

THE second engineering and maintenance base has recently been completed for British European Airways at London Airport at a cost of £6 million. Four years ago development was initiated on a 22-acre site on the south side of the Airport. To meet the maintenance requirements of their increasing air fleet, in particular the Vanguard and Comet 4B, the B.E.A. decided to add to their existing base a new east block hangar of ten bays, with workshops and other ancillary facilities and a new six-storey administrative building. In the new extension there are two hangars of five bays, each hangar being 900ft long by 142ft wide by 40ft high, with 168ft clear span arches over the doors. Between the hangars is the workshop area where, in a completely unrestricted space 900ft by 200ft, work on engines, propellers and power plants is carried out. All the services needed are installed in the 49,200 sq ft of basement which lies beneath the centre workshop. At the north-west corner of the base is an engine test house and at the southern end are sections where ancillaries are overhauled.

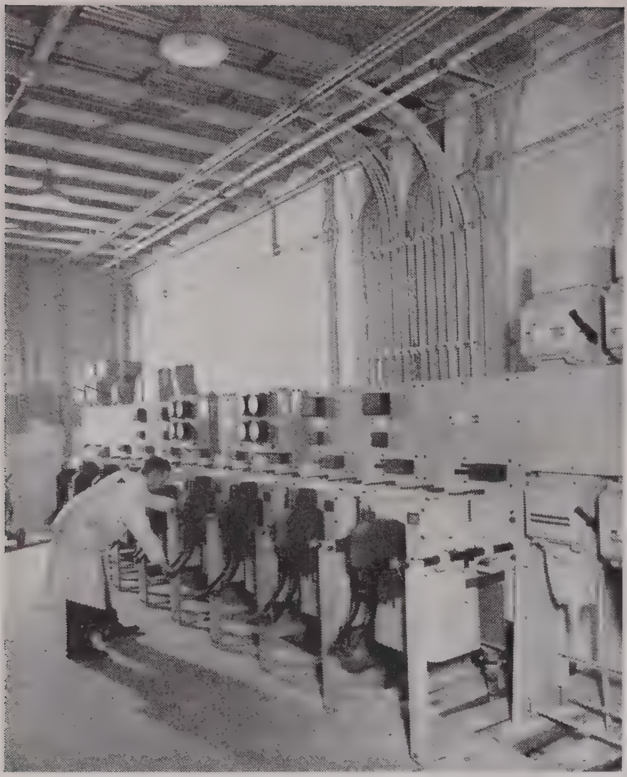
Electrical Services

For the six substations serving the base, which are situated in the basement, Johnson & Phillips, Ltd., supplied and installed the h.v. switchgear and transformers and the 11 kV ring main, pilot and interconnecting cables. The equipment involved consists of four 4-panel type FG switchboards for the office block substation and substations E, F, G, and one five-panel board for substation H. Thirteen 500 kVA, 11 kV/415 V transformers were supplied, two for each of five substations, and three for the overground test bed substation.

After installation of the switchgear and the transformers the original ring main was disconnected between substations No. 3 and No. 4, both of which serve the first engineering base, in order to extend the ring main to the six new substations in the second base. The overground test bed substation, connected by 230 yd of cable, is teed off from the fifth panel in substation H.

About 3,000 yd of cable was installed, including three-core paper insulated, lead alloy sheathed and served 11 kV "E" ring main cable with 0·0045 sq in three-core p.l. and s. 660 V pilot and 0·03 sq in three-core p.l. 11 kV "E" cable left bare for interconnecting the transformers with the switchgear.

In the basement there is one main incoming substation for each of the four substations which, in turn, each feed two plant rooms through two 500 kVA transformers. These services, which are fully cabled by B.I.C.C. with p.i.l.c.s.w.a. cables, supply all the electrical requirements of the ten bays and workshops together with the south workshops. B.I.C.C. have supplied about 250 miles of various



East block basement electrical substation showing B.I.C.C. cabling to Johnson & Phillips switchgear

types of cable for the electrical services which have cost some £800,000.

Each of the ten bays has its own panel for the individual control of lighting and power. Main lighting is provided by 12,400 G.E.C. cold cathode 9ft tubes making in all 22 miles of lighting. This can be operated in three stages, each stage bringing in a third of the lights. At floor level, each hangar bay is provided with five service pits which give a variety of socket-outlets for electric power, ranging from 100 A three-phase to 15 A at 24 V. Additional service outlets with 100 A three-phase sockets are provided on the concrete aprons as well as on mullion units.

The aluminium hangar doors by Esavian are in two 900ft lengths, each length comprising a number of unattached sections driven by power mullions. The leaves fold so that a clear opening of 168ft can be provided at any of the bays as required. The power mullions are supplied through trolley arms from busbars in the hangar roof. This equipment, as well as the insulators, power cut-outs and cabling, is all of B.I.C.C. manufacture.

To provide high- and low-pressure air to service pits and other output points, there is a compressor room in the basement. The compresssors are driven by two 150 h.p. and one 70 h.p. Brush motors, and there is provision for the addition of a second 70 h.p. set if required. A series of lifts convey stores, engines and material to and from the basement. Overhead are electrically-operated travelling cranes with two lanes of crane track every 100ft width.

The administrative block is a six-storey building. On the ground floor, heat is provided through the ceiling and because of this B.I.C.C. mineral-insulated copper-sheathed cable is installed. The building is fully air conditioned, and acoustically and thermally insulated. From the ground floor to the fifth floor access is by internal staircases, and two lift systems, one being of the Paternoster type. The lighting fittings have been supplied by A.E.I. The sixth floor is devoted to the air conditioning plant which works in conjunction with a compressor plant housed in an ancillary block.

The consulting engineers for the project were Scott & Wilson, Kirkpatrick & Partners; the electrical consultants were Barlow, Leslie & Coombes; and the electrical subcontractors were Rashleigh Phipps & Co., Ltd.

Growing Use of Electrical Appliances in the Midlands

A SURVEY recently completed by the Midlands Electricity Board shows that the proportion of homes with electric cookers has risen in five years from 21·5 to 28·7 per cent. The survey covered a representative sample of 12,233 of the 1,252,255 domestic consumers spread throughout the Board's 5,000 square miles area. Taken in 1960, it was statistically identical with the first survey in 1955.

The rural areas lead in the proportion of homes that now cook by electricity. In Shropshire and Herefordshire 48·1 per cent have electric cookers, compared with 34·6 per cent in 1955. The relative figures for the other areas are Worcester 42·6 per cent (33 per cent in 1955), Central Gloucestershire 42·1 (29·5), Wolverhampton 35·1 (29·2), North Staffordshire 30·3 (25·8), South Staffordshire 19·8 (15·1) and Birmingham 17 (11·9).

In the analysis by Districts, North West Birmingham has the lowest figure, with only 10·4 per cent of electric cookers. Leominster leads with 64·6 per cent, followed by Ludlow with 59·9, Severn Vale with 58·6 and Banbury with 56·7.

The survey shows that in the five years the proportion of homes without any form of piped hot water has fallen from 33·3 per cent to 22·4 per cent, while the saturation of electric immersion heaters has risen from 19·1 to 35·5 per cent. Of the Board's seven Sub-Areas, Birmingham has the biggest proportion of immersion heaters, with an overall average of 45 per cent, but this form of water heating is used in 67·8 per cent of homes in Solihull District, while S.W. Birmingham District has 48·3 per cent and Sutton Coldfield and N.E. Birmingham 43·7 per cent.

Electric space heating was found in 68·5 per cent of the homes against 65·3 per cent in 1955, the leading Districts being Solihull 86·1 per cent, Cheltenham 81·2 per cent, Stourbridge 80·5 per cent, Stratford-on-Avon 79·4 per cent, Stroud 79·3 per cent, Redditch 77·5 per cent, Wellington 77·2 per cent and Leominster 76·5 per cent.

In the proportion of refrigerators in use in homes, Solihull also holds leading place among the Board's 36 Districts, with a saturation of 33·6 per cent. Next comes Cheltenham with 32·6 per cent, followed by Gloucester with 25·5 per cent, Stratford-on-Avon with 26·8, Hereford with 23·9, Stroud with 23·8 and Redditch with 23·1. The survey shows a growth in the use of domestic electric refrigerators in all Districts, the proportion in the M.E.B. Area as a whole having risen since 1955 from 6·4 to 17·5, which is believed to be above the national average.

Commenting on the survey, the chief commercial officer of the Board, Mr. H. J. Gibson, said: "We know from unit sales statistics that domestic consumption of electricity is rising steeply in the Midlands, and this survey—the second of a planned series of five-yearly surveys and I think the most comprehensive sample taken by any Area Board—gives us valuable information about why the load is growing and a guide to what we must provide for the future."

the switch that is silent…

'MUTAC CLIPPER'

G.E.C. Installation Equipment Group have a *new approach* to switch design which serves to take the clicking out of switching.

If you listen hard enough you *may* just hear the discreet whisper of a 'Mutac Clipper'.

Furthermore, the *new approach* makes 'Mutac Clipper' switches unrivalled for ease and speed of assembly . . . ensures that these precision-made, electronically-tested switches give a guaranteed long-life performance.

G.E.C.'s *new approach* enables you to put one, two or three 'Mutac Clipper' switches in a standard BS1299 box. There's a choice of 44 different switch plates—in moulded plastic or metal—and 11 interchangeable units fit into just three different sized boxes:

5 amp 1 way S.P.
15 amp 1 way S.P.
5 amp 1 way D.P.
5 amp 2 way S.P.
5 amp 2 way & off
5 amp intermediate
5 amp 1 way secret
5 amp 2 way secret
Bell Push
Neon Indicator
Blanking Unit

'Mutac Clipper' switches cost no more than ordinary switches to buy and far less to install—that's a result of G.E.C.'s *new approach*. Complete interchangeability of 'Mutac Clipper' enables you to standardise right through a job.

that's the New Approach of G.E.C.

INSTALLATION EQUIPMENT GROUP

IMMEDIATE DELIVERY of all 'Mutac Clipper' switches from wholesalers throughout the country. If you would like more detailed information, ask your wholesaler for 'Mutac Clipper' literature.

'HIDUTAC' switchfuses break 8 times their rated full load current

This high breaking capacity is made possible by cam-operated, silver contact, double-break "interruptor" units—just one of many 'Hidutac' exclusive features resulting from the *new approach* of the G.E.C. Installation Equipment Group to switchgear design. The *new approach* has crystallised from G.E.C.'s many years' experience of making switchgear superbly well.

Consider these other impressive advantages: *Unlimited full load switching*—'Hidutac' switchfuses operate at their full load current with unfailing reliability. *A unique compactness*, brought about by radial positioning of contacts. Generous wiring space and easy access to terminals at the front. *Total internal enclosure* of all moving parts, with shields over live terminals. *High fault current protection* in Single Pole and Neutral, Double Pole, Triple Pole and Neutral switchfuses with H.R.C. or rewirable fuses. Categories of duty are: H.R.C. fuses, all ratings, AC4 of BS88 (33000 amp); rewirable fuses, 15 and 30 amp ratings, S2A of BS3036 (2000 amp); rewirable fuses, 60 amp rating, S4A of BS3036 (4000 amp). *Modern styling* of pressed steel case with fully interlocked cover.

These exclusive features make 'Hidutac' switchfuses vastly superior for tungsten and discharge lighting control, motor control, and transformer and capacitor switching.

IMMEDIATE DELIVERY of 'Hidutac' switchfuses from wholesalers throughout the country. For more detailed information ask your wholesaler for 'Hidutac' literature.

that's the New Approach of G.E.C.
INSTALLATION EQUIPMENT GROUP

U.K. Electrical Trade in June

THE Board of Trade returns of imports and exports during June show that shipments of electrical machinery and apparatus were over 20 per cent higher than they were in the corresponding month of 1960. This continued improvement raised the increase for the first half of the year to about 12 per cent compared with January-June, 1960.

In June (see Table 1) exports of generating plant, convertors, transformers, switchgear, etc., were appreciably higher and together they constituted an advance on the figure for the first half of 1960; Australia was the leading customer during this period with South Africa a good second.

An outstanding feature was the increase in exports of accumulators both in June and during the half-year—nearly 30 per cent in the latter period. Exports of electric cooking equipment and parts moved upwards in June, but the total for the first half of the year was a little lower. On the other hand, the exports of space- and water-heating equipment were well up on the half-year (35 per

TABLE I.—ELECTRICAL EXPORTS

Class	Month ended June 1961	Six months ended June 1960	Six months ended June 1961
	£	£	£
Generating sets:			
Diesel driven not exceeding 10 kW	105,718	802,513	677,158
10 kW to 65 kW	170,696	866,145	805,457
65 kW to 200 kW	85,059	713,767	591,888
Over 200 kW	298,166	966,652	1,809,613
Driven by steam turbines	29,101	436,299	149,204
Driven by spark ignition engines, hydraulic turbines or other prime movers	155,419	196,635	639,818
Generators:			
Not exceeding 200 kW	118,610	534,187	795,603
Over 200 kW	86,829	742,298	389,163
Parts	657,688	5,532,922	3,022,255
Motors, complete, other than railway, tramway and trolley-bus:			
Not exceeding ⅛ h.p.	185,021	1,417,385	1,333,569
Over ⅛ h.p. but under 1 h.p.	84,128	406,618	586,862
1 to 250 h.p.	499,994	2,902,880	3,095,978
Exceeding 250 h.p.	169,807	1,099,684	1,033,457
Railway, tramway and trolley-bus motors, complete, and parts of all motors	252,656	1,117,969	1,435,586
Starting and controlling gear for electric motors	357,677	1,583,080	2,263,387
	3,256,569	19,319,034	18,628,998
Converting machinery	37,274	368,797	641,297
Mercury-arc rectifiers	43,811	269,002	329,501
Transformers for lighting, heating and power (including coils):			
Not exceeding 7,500 kVA	473,284	3,064,534	2,433,607
Over 7,500 kVA	325,356	1,565,465	2,665,913
Switchgear and switchboards (excl. telegraph and phone):			
Switchgear up to 220 A and not exceeding 600 V	500,190	2,409,922	3,351,355
Other	1,230,676	6,922,538	7,321,239
	2,610,591	14,600,258	16,732,912
Batteries and/or cells, primary:			
For all lighting purposes	159,065	646,978	822,976
For radio	362,023	2,322,762	2,502,713
Other	48,219	242,128	295,308
Parts (excluding carbons)	80,435	313,087	418,263
Filament lamps exceeding 28 V	120,334	614,239	652,674
Not exceeding 28 V	22,991	180,111	212,329
Arc lamps, discharge lamps, luminous tubes, fluorescent tubes and tube signs, complete:			
Fluorescent tubular lamps	101,136	407,591	550,386
All other lamps	29,830	176,717	224,424
Parts (excluding glass bulbs and carbons)	60,336	281,625	464,242
Radio and television, etc., apparatus:			
Thyratrons, hot cathode mercury vapour and gasfilled rectifiers (excluding mercury-arc rectifiers), photo-electric cells (excluding phototransistors), stabilising and cold cathode valves, magnetrons, klystrons	89,438	326,713	429,318
Cathode ray tubes	161,525	336,936	778,337
All other	575,267	2,274,245	3,678,227
Parts (excluding glass bulbs)	60,134	310,294	465,656
Broadcasting and television transmitters	24,285	321,782	415,326
Communication and navigational and radar equipment	1,713,199	9,061,886	10,853,454
Domestic receiving sets, mains	50,363	432,537	337,737
Battery (incl. complete vibrator sets)	72,560	499,965	585,201
Other (incl. mains/battery and radio for cars)	36,075	195,584	202,353
Radiograms	24,083	185,474	185,329
Television receiving sets	66,824	368,580	661,780
Public address equipment	103,624	585,810	555,824
Other radio and television apparatus, n.e.s.	210,884	668,197	1,158,989
Components and parts, n.e.s.	1,420,997	6,845,388	7,767,219
	4,609,258	22,413,391	28,074,750
Telegraph and telephone installations	481,773	3,820,456	2,735,590
Telephone instruments	272,296	922,912	1,234,881
Parts	914,364	4,292,610	5,223,024
Line app. for long distance communication	228,982	1,439,274	1,640,710
	1,897,415	10,475,252	10,834,205
Cookers	34,547	248,900	262,254
All other cooking appliances	63,258	346,773	360,599
Parts and accessories	103,336	548,521	493,434
Space heating appliances	19,264	138,093	146,542
Water heating appliances	42,135	179,545	240,327
Other heating appliances	53,128	163,345	290,358
Parts and accessories	117,960	520,389	680,647
Irons	78,040	431,050	452,189
Arc welding equipment, a.c.	34,366	276,256	348,748
D.c.	43,188	338,864	275,659
Resistance welding equipment	102,633	224,394	343,693
Electric furnace plant	103,934	596,343	598,664
Sparking plugs	221,786	1,342,973	1,238,836
Electrical appliances, for aircraft	342,404	1,767,139	1,825,457
For motor vehicles	636,893	3,788,582	4,094,619
For cycles	36,149	303,464	224,490
Signalling apparatus (incl. traffic signals)	187,480	713,553	918,123
Instruments, commercial	178,396	1,170,196	1,195,599
House service meters (electrical) incl. parts	187,129	985,808	1,034,427
Electro-medical apparatus (excluding deaf-aids and X-ray apparatus and batteries)	46,691	241,962	212,270
X-ray apparatus (excl. tubes and valves)	62,444	292,958	443,893
Ceiling fans	121,034	528,629	723,563
Desk fans, and parts of desk and ceiling fans	38,915	151,399	220,961
Portable mechanical appliances, electrically operated:			
Vacuum cleaners	256,263	900,293	1,416,688
Floor polishers	62,508	426,553	346,878
Food mixers	73,674	332,460	491,552
Hair clippers and dry shavers	107,823	534,363	722,287
Other portable appliances	47,373	182,411	388,896
Parts	145,730	1,091,529	1,148,854
Portable elec. tools, incl. parts	351,675	1,491,373	1,880,798
Telegraph and telephone cables and wires:			
Submarine	1,428	1,313,699	70,891
Other	449,900	2,402,594	2,313,996
Other descriptions:			
Cotton, silk or man-made fibres insulated	35,398	136,632	206,883
Enamel, glass or asbestos insulated	181,689	637,387	892,295
Paper insulated	423,405	3,502,581	3,197,812
Rubber insulated	255,528	1,618,330	1,778,792
Thermoplastic insulated	393,085	1,938,244	2,158,409
Other	209,773	1,251,762	1,391,944
	1,950,206	12,801,229	12,011,022
Accumulators for motor vehicles	190,622	775,377	946,107
For radio, and other portable	27,450	213,361	213,417
All other accumulators	48,825	251,449	464,437
Parts and accessories	116,715	524,563	732,807
Electric wiring accessories	246,464	1,312,046	1,487,964
Electrical ware (including insulators) of ceramic materials, n.e.s.	154,282	747,058	798,243
Industrial electronic control equipment	186,103	963,352	1,148,019
Insulators and insulating materials (elec.)			
Cloth and tape	71,835	430,163	388,495
All other	159,063	833,471	823,329
Permanent magnets	55,582	374,103	418,918
Radio, telegraph and telephone testing equipment, n.e.s.	138,496	923,901	857,161
Scientific electrical instruments (excluding telegraphic and telephonic; time recorders and time switches)	771,809	2,461,155	3,876,335
All electric machinery, apparatus and appliances, n.e.s.:			
Machinery	57,031	184,663	392,857
Other	1,289,114	5,668,012	7,005,937
	22,721,955	120,715,194	135,000,533

TABLE 2.—DISTRIBUTION OF EXPORTS (TABLE 1)

Country	Month of June, 1961	Six months ended June	
		1960	1961
	£	£	£
Gibraltar	34,144	108,298	230,030
Malta	82,988	276,663	360,147
Cyprus	90,539	426,853	468,125
Sierra Leone	49,616	207,863	373,861
Ghana	268,567	1,557,934	1,938,632
Nigeria	398,564	3,112,189	2,710,530
Union of South Africa	1,483,796	8,334,523	9,584,081
Rhodesia and Nyasaland	683,143	3,935,066	4,107,485
Tanganyika	56,230	311,466	317,586
Kenya	183,428	1,050,562	973,972
Uganda	51,157	182,619	348,299
Mauritius	47,907	348,464	229,582
Aden	78,263	336,149	487,158
Bahrain, Qatar and Trucial States	176,592	666,675	923,033
Kuwait	306,794	1,333,847	1,717,035
India	1,154,475	8,027,162	6,754,157
Pakistan	412,259	1,924,688	1,944,736
Singapore	243,123	1,240,432	1,465,761
Federation of Malaya	308,853	1,182,425	1,777,735
Ceylon	197,203	1,060,150	1,092,250
British North Borneo	9,569	130,855	152,984
Sarawak	11,332	103,397	63,654
Hong Kong	423,692	2,346,082	2,923,191
Australia	1,935,620	10,795,580	11,454,087
New Zealand	1,099,124	5,082,162	6,723,856
Fiji	26,044	134,358	193,255
Canada	1,247,134	7,656,850	6,826,054
Bermuda	78,650	239,118	334,801
Bahamas	35,906	333,680	245,628
Jamaica	169,918	1,002,991	1,109,397
Barbados	25,083	267,541	231,542
Trinidad	125,190	971,651	851,565
British Guiana	56,964	405,539	321,325
Other Commonwealth countries	116,246	571,938	600,279
Irish Republic	540,448	2,429,551	3,158,918
Soviet Union	147,495	787,498	1,612,441
Finland	156,707	1,086,777	1,137,468
Sweden	559,680	3,186,173	3,478,818
Norway	340,174	1,518,053	1,994,069
Denmark	530,107	1,544,789	1,981,065
Poland	252,262	562,421	788,720
Western Germany	873,922	2,881,550	4,350,612
Netherlands	849,974	3,439,485	5,533,540
Belgium	291,091	1,702,885	1,886,885
France	633,423	1,971,645	3,269,901
Switzerland	183,078	832,504	1,297,536
Portugal	243,285	1,307,710	998,152
Spain	160,675	1,337,219	1,374,359
Italy	642,558	2,301,985	3,432,980
Austria	97,864	398,891	581,369
Yugoslavia	119,418	691,253	656,401
Greece	117,367	575,600	680,197
Turkey	278,630	517,533	915,246
Portuguese East Africa	50,237	324,612	182,066
Egypt	115,745	641,330	712,324
Libya	69,319	356,168	397,821
Morocco (incl. Tangier)	26,378	150,661	158,522
Congo Republic	41,623	336,292	245,928
Sudan	149,395	697,442	1,173,940
Syria	39,974	267,117	319,774
Lebanon	66,630	365,029	484,776
Israel	206,113	544,948	1,044,762
Jordan	94,962	471,088	477,206
Saudi Arabia	82,983	356,663	473,648
Iraq	295,931	1,399,189	1,923,813
Iran	239,194	1,276,046	1,824,052
Burma	68,885	301,607	325,180
Thailand	54,303	322,675	394,028
Indonesia	80,832	557,089	1,525,418
China	59,463	745,203	491,472
Japan	107,663	295,816	427,439
United States of America	933,348	7,455,352	4,972,843
Cuba	26,935	188,774	123,202
Mexico	55,053	593,553	616,100
Columbia	21,405	287,694	251,809
Venezuela	67,941	2,192,467	607,574
Peru	40,903	180,459	258,798
Chile	79,147	488,936	797,047
Brazil	131,712	331,024	500,510
Uruguay	16,074	141,938	113,003
Argentine Republic	398,954	2,496,950	2,389,470
Other foreign countries	414,582	2,209,781	2,823,518
TOTAL	22,721,955	120,715,194	135,000,533

TABLE 3.—SOURCES OF ELECTRICAL IMPORTS

Country	Month of June, 1961	Six months ended June	
		1960	1961
	£	£	£
Australia	73,167	199,833	390,534
Canada	169,295	679,477	1,138,694
Other Commonwealth countries	320,450	1,118,290	1,436,524
Irish Republic	136,037	656,461	765,154
Sweden	176,516	576,987	1,371,858
Denmark	136,370	398,327	603,126
Western Germany	913,125	4,577,880	5,185,576
Netherlands	658,647	3,548,346	3,706,638
Belgium	91,062	262,966	335,992
France	356,363	1,011,048	1,537,644
Switzerland	228,877	911,478	1,274,655
Italy	148,997	767,522	701,267
United States of America	1,709,254	8,701,795	9,676,476
Other foreign countries	430,257	1,220,385	2,246,309
TOTAL	5,548,417	24,630,795	30,370,447

cent). Similarly, shipments of domestic appliances, other than floor polishers, made a noteworthy advance.

Looking at the distribution of electrical exports (Table 2) it will be seen that Australia was well in the lead in June, and that South Africa, Canada, India and New Zealand were also valuable customers. Among other buyers the United States and Western Germany were outstanding.

Exports of items shown separately in the returns also advanced during the six months on the whole. A falling-off in steam turbines was redressed by greater shipments of water and gas turbines.

Electrical Imports

Imports of electrical machinery and equipment also rose substantially in June, the leading suppliers being the United States and Western Germany. For the first half of the year an increase of about a quarter is shown. The United States was responsible for about a third of the £30 million-odd total, followed at some distance by Western Germany and the Netherlands. An outstanding rise occurred in the case of Sweden—a fellow E.F.T.A. country.

TABLE 4.—OTHER ELECTRICAL AND ALLIED EXPORTS

Class	Month of June, 1961	Six months ended June	
		1960	1961
	£	£	£
Domestic electric washing machines incorporating centrifugal water extraction	464,285	1,625,141	2,352,712
Other, with or without wringers	281,542	1,386,483	1,388,521
Dryers (exported as separate units)	19,772	225,133	213,640
Parts	207,644	657,052	960,924
Electric locomotives (incl. battery types)	63,963	1,914,665	1,555,824
Diesel locomotives with electric transmission	—	1,535,788	176,144
Welding electrodes:			
Ferrous	117,828	758,000	625,823
Non-ferrous	29,832	143,003	189,305
Electric conduit tubes and cased tubes	97,048	545,787	613,599
Electric carbons	213,942	647,260	1,064,682
Electric lighting fittings and lanterns (excl. arc lamps, searchlights and cycle lamps)	357,383	2,072,374	2,175,492
Electric fork-lift trucks	150,724	580,534	1,067,142
Water and gas turbine, etc.	662,480	2,690,424	5,011,478
Steam turbines	1,180,878	6,531,083	4,288,939

TABLE 5.—ELECTRICAL IMPORTS

Class	Month of June, 1961	Six months ended June	
		1960	1961
	£	£	£
Generators, incl. parts	146,855	407,457	653,688
Motors, incl. parts	262,352	1,068,487	1,581,725
Converters; transformers; rectifiers	135,488	958,711	1,021,786
Switchgear and switchboards (other than telegraph and telephone)	169,725	879,756	1,301,263
Bulbs, arc lamps and tubes for electric lighting, complete	136,188	529,887	648,318
Cathode ray tubes, complete	54,459	290,996	215,120
Transistors (including photo-transistors), complete	82,545	629,692	529,190
Other, complete	283,347	1,402,112	1,635,730
Parts (excl. glass bulbs)	88,829	647,218	514,554
Radio receiving sets, domestic or portable	108,655	250,409	471,954
Radio communication and navigational aids, complete	409,387	2,487,521	2,784,190
Other radio and TV apparatus, parts and accessories	619,519	2,158,163	2,807,270
Telegraphy and telephony apparatus	88,157	328,116	371,245
Welding machinery	101,320	394,445	569,763
Electrical cooking and heating apparatus	243,103	977,945	1,371,468
Magnetos, ignition, and electric appliances for aircraft, motor vehicles and cycles	370,139	1,751,788	1,820,193
Instruments, commercial	157,648	489,014	713,962
Electro-medical apparatus (incl. X-ray apparatus)	91,682	612,276	852,735
Portable mechanical appliances, electrically operated, complete	206,321	702,503	950,476
Parts	52,191	377,128	348,935
Industrial electronic control equipment	140,749	311,486	648,357
Scientific electrical instruments (excl. telegraphic and telephonic)	302,121	1,010,043	1,406,617
Other machinery, apparatus and appliances	1,297,637	5,965,642	7,214,908
TOTAL	5,548,417	24,630,795	30,370,447

PERSONAL AND SOCIAL

News of Men and Women of the Industry

An advertisement in the current issue of the *Journal* of the Institution of Electrical Engineers indicates that the secretary, **Mr. W. K. Brasher,** is to retire at the end of September, 1962. It states that Mr. Brasher's successor should be between the ages of 40 and 50 and preferably be a corporate member of the Institution. The new secretary will commence his service in June, 1962, and work in collaboration with Mr. Brasher for three months.

Mr. V. J. Faulkner is leaving Crompton Parkinson, Ltd., this week after 25 years as the company's publicity manager and will spend his retirement in Devon. He has for many years been an active member of the B.E.A.M.A. and I.S.B.A. Publicity Committees. His successor as from 1st August will be **Mr. E. F. Robinson,** for several years past the company's assistant publicity manager. Mr. Robinson's publicity career has principally been concerned with the electrical and allied industries over the past 15 years. He qualified as an electrical engineer originally, when with Central Rediffusion Services, Ltd., and, subsequently, he has held appointments with the publicity organisations of British Insulated Callender's Cables, Ltd., and Johnson & Phillips, Ltd., before joining Crompton Parkinson, Ltd., in 1954.

Mr. V. J. Faulkner

Mr. E. F. Robinson

Dr. W. J. Gibbs, M.I.E.E., has relinquished his appointment as manager of the Engineering Mathematics Department of Associated Electrical Industries (Rugby), Ltd., but remains as a group company consultant. **Mr. N. Kerruish,** M.A., A.M.I.E.E., succeeds Dr. Gibbs as manager.

A Bristolian, Dr. Gibbs joined the British Thomson-Houston Co., Ltd., at Rugby in 1920 in the Test Department. He was transferred to the then A.C. Engineering Department as a design engineer in 1923 and worked in various sections of the department in turn. In 1951 he was appointed consulting engineer in mathematics and in 1958 he became the first manager of the newly formed Engineering Mathematics Department. Dr. Gibbs was chairman of the Rugby Sub-Centre of the Institution of Electrical Engineers in 1959-60; a visiting lecturer on the staff of Manchester University, 1958-61, and director of studies, A.E.I. Staff Courses, 1958-61. He is the author of "Tensors in Electrical Machine Theory" and "Conformal Transformations in Electrical Engineering." Another work, "Electric Machine Analysis using Matrices," is to be published shortly. He is also part-author with Dr. B. Adkins of "Polyphase Commutator Machines."

Mr. Kerruish is a native of Wigan. Whilst at St. John's College, Cambridge, he was a Wrangler in the Mathematical Tripos. He joined the British Thomson-Houston Co. in 1948 and from then until his present appointment served as consultant mathematician and lecturer for the Advanced Engineering Course, first with Dr. B. Adkins in the Plant Engineering Department, then with Dr. V. J. Gibbs in the department of which he is now manager. In 1959 he was awarded an I.E.E. Supply Section Premium jointly with Dr. J. H. Walker.

Mr. Harry West, M.Sc., M.I.Mech.E., M.I.E.E., managing director of A.E.I. (Manchester), Ltd., was installed as president of the Institute of Welding for 1961-62 at the annual general meeting on 13th

SIR JOSIAH ECCLES

AS we have already reported, Sir Josiah Eccles, C.B.E., D.Sc., M.I.C.E., M.I.E.E., M.I.Mech.E., is retiring from the position of deputy chairman of the Electricity Council on 31st July after a distinguished career in the electricity supply industry extending over about thirty-three years.

Sir Josiah was born in Dungannon, Northern Ireland, in 1897, and he is a graduate (B.Sc.) of Queen's University, Belfast, which in 1956 made him an honorary D.Sc. After serving in the 1914-18 war, during which he was awarded the Military Medal, he joined the Metropolitan-Vickers Electrical Co. with whom he remained until 1928. He then went to Edinburgh as senior technical assistant in the Corporation Electricity Department, eventually becoming deputy engineer and manager and later "chief" (1940-43). His next appointment was as city electrical engineer of Liverpool, a position which he occupied until the nationalisation of the industry when he became chairman of the Merseyside and North Wales Electricity Board.

Sir Josiah Eccles

When Sir John Hacking retired from the post of deputy chairman of the British Electricity Authority at the end of 1953, Sir Josiah was appointed to succeed him. He remained as a deputy chairman of the Central Electricity Authority after the changes made by the Electricity Reorganisation (Scotland) Act of 1954 and then when the structure of the industry was fundamentally altered he became a deputy chairman of the Electricity Council, the position from which he is now retiring.

Sir Josiah, who was knighted in 1957, has been active in many sectors of the electrical profession and industry. He was President of the Institution of Electrical Engineers in 1954-55, president of the British Electrical Power Convention in 1957, of the Association of Supervising Electrical Engineers in 1958-59, and of the Liverpool Engineering Society in 1950. He has also served as chairman of the E.D.A. Council and as a member of the Clean Air Council.

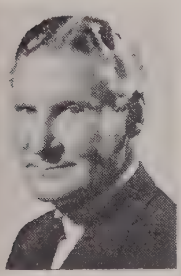
It was recently announced that Sir Josiah was to attend an electric power "seminar" to be held in Mexico City from 31st July to 12th August; he is to present papers entitled "Basic Problems in Electric Power Development" and "Operational and Institutional Problems of Electric Power Development."

July. Two new vice-presidents also took office—**Mr. C. Humphrey Davy,** M.I.Mech.E., director of Babcock & Wilcox, Ltd., and **Mr. L. Redshaw,** M.Eng., M.R.I.N.A., deputy managing director of Vickers-Armstrongs (Shipbuilders), Ltd.

Mr. R. G. Worthing, A.M.I.E.E., at present district engineer in the Birmingham South East District of the Midlands Electricity Board, has been appointed manager of the Board's Solihull District. He will succeed **Mr. J. A. P. Firth,** M.I.E.E., who is leaving Solihull to become manager of Birmingham S.E. District. Mr. Worthing joined the staff of Birmingham Corporation Electricity Supply Department as a trainee in 1927 and became assistant meter engineer in 1932. Later he held a number of appointments in the mains department of the Birmingham undertaking. Following the formation of the M.E.B. in 1948 he was appointed district engineer at Solihull and in 1950 he was promoted to a similar position in the Birmingham South East District.

Mr. K. R. Johnston, B.Sc.(Eng.), A.M.I.E.E., has been appointed assistant superintendent, Turbo-Generator Plant Department, at the Trafford Park Works of Associated Electrical Industries (Manchester), Ltd. He was previously assistant superintendent of the Large Electrical Department.

Mr. A. R. Enshaw has been appointed executive director in charge of the Government Contracts Department of the Plessey Co., Ltd. Mr. Enshaw, who was previously manager, Telephone Apparatus Department, joined the company in 1946. He served in the R.A.F. during the last war with the rank of squadron leader.



Mr. A. R. Enshaw

On his retirement after 40 years' service with Chloride Batteries, Ltd., **Mr. L. Hansen** was presented with a clock by members of the staff. The presentation was made by Mr. C. Pritchett, director. Mr. Hansen spent nearly 28 years in India on the company's behalf. In 1926 he became manager of their Bombay office and shortly before the end of the war he was appointed general manager of Chloride & Exide Batteries (Eastern), Ltd., in which capacity he was responsible for the Chloride organisation throughout India, Ceylon and Burma. In 1949 Mr. Hansen returned to this country to deal with the company's arrangements with railways, both home and overseas. Two years later he assumed responsibility for traction and stationary business in Southern England, and in 1953 he took over complete control of all railway business in the British Isles.

Mr. Sydney Jones, Ph.D., B.Sc., M.I.E.E., until recently director of research applications of the Central Electricity Generating Board, has joined R. B. Pullin & Co., Ltd., as technical director. Between 1947 and 1950, while at T.R.E., he became interested in the problem of automatic guidance of astronomical telescopes and worked with Professor Tustin at Birmingham on a scheme to develop a high precision servo-drive of the photographic plate on the Isaac Newton telescope. About this time he was also leading the Royal Radar Establishment team responsible for the application of infra-red to guidance of missiles and other devices. This work led directly to the Firestreak missile. Many of the novel techniques in this missile arose from his work and, in conjunction with the Ministry of Supply, he holds many of the patents involved. Dr. Jones was Superintendent of Defence Airborne Radar at Malvern from 1954 to 1956, and headed the Armament Department, R.A.E., in 1956-59. In this capacity, he went to Christmas Island in 1958 and was an official observer at the last British megaton test.

Dr. S. Jones

Mr. W. G. Creasy, B.Sc., has been appointed acting manager of the Preston and Trent Vale factories of the A.E.I. Lamp & Lighting Co., Ltd. He will be based at Preston, Lancs., and succeeds the late Mr. E. G. Fryer. Mr. Creasy was previously superintendent of the Preston factory, a post he had held since 1956. The new superintendent is **Mr. W. G. Ashworth.**

Mr. Frank Bradford, general manager of the Production Products Division, and **Mr. Frank Smith,** A.M.I.Mech.E., general sales manager, have been co-opted to the board of Headland Engineering Developments, Ltd.

Mr. C. J. Rathmell, who was a student apprentice with South Wales Switchgear, Ltd., has been appointed joint resident technical engineer for the sale and servicing of heavy electrical engineering equipment in West Africa. The manufacturers which he is representing are South Wales Switchgear, Doulton Industrial Porcelains, Ltd., and Line Equipment, Ltd.

We are pleased to learn that **Mr. E. A. Fowler,** M.I.E.E., has now fully recovered from his recent illness. He wishes to express his appreciation to the many friends in the industry who have kindly made inquiries. Mr. Fowler, who relinquished his appointment as a group managing director in the G.E.C., following further reorganisation, has now retired from the service of the company.

Before accepting an invitation to join the G.E.C. in 1955 Mr. Fowler was chief commercial officer to the Eastern Electricity Board, having previously held a senior executive appointment for many years with the Yorkshire Electric Power Group. He gained his early experience with the County of London Electric Supply Co. and the Strand Electric & Engineering Co. Mr. Fowler is still living at Felixstowe and his new telephone number is Felixstowe 3002.

Mr. J. E. Bailey has been appointed export manager to Advance Components, Ltd., of Hainault, Essex. He was previously with Belling & Lee, Ltd. Mr. Bailey hopes to visit many of the company's agents overseas during the next year.

Mr. J. E. Bailey

Seventeen employees of **E. K. Cole, Ltd.,** received gold watches from Mr. E. K. Cole, C.B.E., chairman and managing director, at a ceremony to mark their completion of 25 years with the company on 11th July.

Mr. A. A. Farrell has been appointed director and general manager of Plessey Ireland, Ltd., and a director of Plessey Sales, Ltd., Dublin.

Philips Electrical, Ltd., have appointed **Mr. Malcolm Davey** as product manager in their recently-formed Major Domestic Appliance Group. Mr. Davey was formerly assistant marketing manager, portable appliances, with A.E.I.-Hotpoint, Ltd.

Mr. John Stanley, formerly export manager of the Martindale Electric Co., Ltd., has been appointed assistant manager of Martindale Electrique S.A., Boulogne-sur-Seine, France, the wholly-owned subsidiary of the Martindale Electric Co. It is intended that the French company should be the headquarters of the Martindale group's Common Market interests.

Mr. W. Crichton Vile who, as recently reported, has been appointed manager of the South Wales Electricity Board's Barry District

At the annual general meeting of the British Welding Research Association **Sir Charles S. Lillicrap** was re-elected president. Viscount Ednam and Mr. W. Muirhead Watson were elected to the Council and Messrs. D. J. W. Boag, C. H. Davy, T. McIver, R. B. Shepheard and Dr. T. W. F. Brown were re-elected.

Mr. O. Mansager has relinquished his position as deputy chairman of Hoover, Ltd., but he remains on the board. **Mr. Arthur F. Earle** has been appointed a director and elected deputy chairman in his place.

Mr. H. F. Judd, Associate I.E.E., has been appointed managing director of Ioco, Ltd., as from 1st August, on Mr. J. A. Killick's leaving to take up another position within the Vickers Group.

Colonel J. F. Williams-Wynne, D.S.O., J.P., who has been appointed to serve on the National Parks Commission, is a part-time member of the Merseyside & North Wales Electricity Board.

Following the election of **Mr. H. B. Morris** to the board of Wickman, Ltd., **Mr. H. Andrews** has been appointed secretary and **Mr. H. L. Hudson** chief accountant.

At the annual general meeting of the Scientific Instrument Manufacturers' Association on 13th July **Mr. A. W. Jones** (Fleming Radio (Developments), Ltd.) was installed as president for the year 1961-62.

Mr. H. C. H. Matthews, B.Sc., A.M.I.E.E., has been appointed a technical director of Pantak, Ltd., of Windsor, Berks.

Dr. A. S. Eklund (Sweden) is to succeed **Mr. Sterling Cole** (U.S.) as director of the International Atomic Energy Agency on 30th November. Dr. Eklund acted as secretary general to the second United Nations Geneva Conference on the Peaceful Uses of Atomic Energy in 1958 and is chairman of the international board of management, O.E.E.C. High Temperature Reactor Project "Dragon," at Winfrith Heath.

Mr. R. W. Beer, 6, Hilton Place, Llandaff North, Cardiff, has joined Sunbeam Electric, Ltd., as area manager for South Wales and the South West of England.

Mr. P. Y. Moyse, formerly sales manager, has been appointed general manager of Pinchin Johnson & Co., Ltd.

Mr. John P. Bolton has been appointed managing director of the Australian subsidiary of the George Cohen 600 Group, Ltd. He succeeds the late Mr. C. A. Bell.

Mr. G. V. Cox has been appointed general manager of sales, plastics products, of Monsanto Chemicals, Ltd., and **Mr. M. W. Waugh** general manager of sales, chemical products.

OBITUARY

Dr. G. C. J. Dalton.—The death occurred recently, at the age of 45, of Mr. George Clifford James Dalton, D.Phil.(Oxon.), director of the Sydney, N.S.W., nuclear research establishment of the Australian Atomic Energy Commission. Dr. Dalton was a Rhodes Scholar; he served in the R.A.F. during the war, working on radar, and returned to Oxford afterwards. For two years or so he was engaged in research at Harwell as a member of the Engineering Division. He returned to New Zealand, his native country, in 1949 as Professor of Mechanical Engineering at Auckland and in 1955 he was appointed chief engineer of the Australian atomic energy project. He took up the post of director of the Australian A.E.C. research establishment last year.

Mr. D. R. Williams, B.Sc.(Eng.), M.I.E.E., A.M.I.Mech.E., F.Inst.F., manager of the No. 7 (Grimsby) Sub-Area of the Yorkshire Electricity Board, died suddenly on 21st July. Mr. Williams, who before vesting day was borough electrical engineer of Grimsby, was born at Penrhiwceiber in 1908. After practical training in Switzerland with Brown Boveri and Sulzer Bros., he held appointments with the Shropshire, Worcestershire & Staffordshire Electric Power Co. and Powell Duffryn Associated Collieries, Ltd. In 1939 he took up the position of technical assistant and constructional engineer with the West Midlands Joint Electricity Authority and from 1944 until he went to Grimsby he was deputy chief engineer of the Stretford & District Electricity Board.

Mr. E. S. Ely, M.I.Mech.E., M.I.E.E., who in 1958 retired from the position of docks mechanical and electrical engineer at Southampton, died recently. Mr. Ely was apprenticed in the Electrical Engineer's Department at the Docks and after service with Allen West & Co., Ltd., and the English Electric Co., Ltd., he returned to the Docks as engineering draughtsman in 1928, becoming an assistant electrical engineer in 1940, electrical engineer in 1943 and mechanical and electrical engineer in 1951. In addition to post-war schemes at Southampton Docks he was responsible for the improvement of mechanical and electrical equipment at Newhaven, Folkestone and Dover.

Mr. T. C. Hale, joint managing director of the Cape Asbestos Co., Ltd., died in London on 13th July, after a long illness, at the age of 57. Mr. Hale started in 1921 as a junior clerk at the company's Barking works, of which he became plant manager in 1943. He was appointed to the board as technical director in 1953 and became joint managing director with Mr. R. H. Dent in 1957. He was a member of the Asbestos Research Council and was chairman of its Management Committee at the time of his death.

Mr. W. C. C. Turner, formerly of Crompton Parkinson, Ltd., died on 23rd July in his 82nd year. He joined Crompton & Co. at Chelmsford in 1898 and after completion of his apprenticeship was appointed arc lamp specialist, a position which he held until 1914. In 1918 he took charge of instrument sales, combining the function of salesman and technical adviser, particularly to educational establishments to whose interests he devoted most of his time. Although Mr. Turner officially retired in 1940 he served in an advisory capacity until 1959 when failing health forced him to curtail his activities.

Mr. P. Blunt.—The death occurred suddenly on 21st July of Mr. P. Blunt, B.Sc., M.I.E.E. Mr. Blunt, who was 49, joined the Merseyside & North Wales Electricity Board as deputy sub-area engineer in 1951 and became sub-area engineer, No. 4 Sub-Area, in 1954. Previously, he had served with the Midlands Electricity Board.

Mr. William Harpley, deputy general manager of the Preston works and Samlesbury Flight Sheds of the English Electric Co., Ltd., died suddenly at his home recently. He was 60.

Control of Public Expenditure

POSITION OF THE NATIONALISED INDUSTRIES

THREE years ago a recommendation was made by the Select Committee on Estimates that a small independent committee having access to Cabinet papers should be appointed to report on the theory and practice of Treasury control of expenditure. The Government did not accept the recommendation in favour of an outside committee, but instead they set in hand an internal inquiry to review the whole field of the control by the executive of public expenditure. The work was undertaken by Lord Plowden who was assisted by a Group of people both in and outside Government service. A number of confidential reports were made to the Government together with recommendations some of which, it is stated, have already taken effect. These interim submissions have now been consolidated in the form of a report which the Government has issued as a White Paper.*

The central problem is seen to be that of how to bring the growth of public expenditure under better control and how to contain it within such limits as the Government may think desirable. There is no discussion of whether the Government policy should be one of high or low levels of public expenditure but merely of how the level can be kept to what is thought to be right. The report has three main themes: surveying expenditure as a whole, over a period of years, in relation to prospective resources; the need for greater attention to be paid to the systematic improvement of management throughout the public service; and the opportunities for constructive Parliamentary control. The report is in four parts dealing respectively with the system of making decisions about Government expenditure, the responsibilities of the Treasury and the Departments, the role of Parliament, and the concluding observations of the Group. No specific recommendations are formulated.

Group's Conclusions

As regards Government planning the Group came to a definite conclusion that decisions involving substantial future expenditure should always be taken in the light of surveys of public expenditure as a whole, over a period of years, and in relation to the prospective resources. The present tendency is for expenditure decisions to be taken piecemeal, and for the merits of any particular proposal to be related, at most, to a general background of the financial situation, rather than upon the competing claims on the present and future resources of the country which are represented by the aggregate of the spending policies of the Government. (An exception to this tendency is, however, noted in the case of public investment.)

To this end a reconstruction is recommended based on four elements, namely:—Regular surveys of public expenditure as a whole over a period of years ahead; the greatest practicable stability of decisions on public expenditure when taken; improvements in the tools for measuring and handling public expenditure problems; and more effective machinery for the taking of collective decisions and the bearing of responsibility by Ministers.

Short-Term Measures

Of particular interest to the electricity industry is the recognition in the report that short-term " economy campaigns " and " stop-and-go " are damaging to the real effectiveness of control of public expenditure. Experience has shown that current Government expenditure cannot be varied effectively for the purpose of maintaining the short-term stability of the national economy. In the case of public investment at least six to nine months (and often more) must elapse before short-term changes in either direction take full effect. In the two-year period from high to low which seems to characterise post-war fluctuations in the economy, the effect of the action taken may well appear at the very moment when the economy is already on the turn. The remedy may, therefore, be worse than the disease. Nevertheless, it is believed that there must be some possibility of achieving small but significant and timely variations in public investment to help to keep the economy stable and it is hoped that they will be examined in discussion with the various public authorities.

Effect on Management

In the other fields, namely, Departmental responsibility and Parliamentary control, a number of desirable aims are outlined, but there are few tangible suggestions as to how they can be achieved. It is pointed out that, whilst the low average return on capital in the nationalised industries and their heavy claims on the Exchequer have inevitably led to proposals for tighter Parliamentary control of their finances, any move in this direction would weaken the management of these industries at the very time when such management is in need of strengthening. In fact, the report makes it clear that, within the context of the Government's policy of defining the financial obligations of the naionalised industries, the overriding consideration is to strengthen their managements.

Reference is made to the work of the Select Committee on Nationalised Industries, and two forthcoming White Papers are announced which will concern, *inter alia,* the finances of these industries: one on the future investment plans in the Public Investment White Paper in the autumn, and one on the annual requirements for Exchequer lending in the White Paper on Government Expenditure Below the Line in the spring. These, together with the accounts of the enterprises themselves, are felt to be suitable and appropriate for the purpose of informing Parliament. Moreover, it is suggested that there may be a useful prototype here for the development of Parliamentary discussion of wider areas of public expenditure.—D.J.B.

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* Control of Public Expenditure. Cmnd. 1432. H.M. Stationery Office, price 1s 9d net.

INDUSTRIAL NEWS

Financial Proposals

In a speech to the House of Commons last Tuesday, the Chancellor of the Exchequer, Mr. Selwyn Lloyd, gave details of his plans to check the threat of inflation. This, he said, was the third year running in which we had had a deficit in our balance of payments. His main proposals were that from midnight on 25th July there would be a surcharge of 10 per cent on Customs and Excise duties and on purchase tax. This would mean a 10 per cent increase in the existing rate and not an additional 10 per cent. The effect would be to cut the nation's purchasing power by £200 million a year. The Chancellor also stated that the Bank Rate would be increased from five to seven per cent but the present hire-purchase arrangements would not be altered. The Bank of England would call on clearing banks for further special deposits to restrict their lending and would reduce existing commitments where they related to personal spending, hire-purchase or property development. Loans to local authorities would be considerably reduced. There would be cuts in Government spending overseas and the defence programme would be carefully examined.

On becoming Chancellor, one of Mr. Lloyd's first actions was to call for a plan of the programme for development and expenditure in the public sector five years ahead. He said that he intended to discuss urgently with both sides of industry procedures for co-ordinating forecasting. With regard to public expenditure, he did not wish to disrupt programmes under way. He was not therefore going to interfere with the investments that the nationalised industries required for attaining their financial targets and providing essential supplies and services. He looked to overseas branches of British firms to remit home a higher proportion of their earnings.

The Chancellor did not consider that a further general increase in dividends in the coming year was justified, but certain profits at present tax free should be brought within the existing system of taxation next year. With regard to wages and salaries, he said, there was to be a wage "pause" in Government and the public services and in the nationalised industries. Private industry would be asked to follow this example so that the wage pause would spread. The Chancellor did not mention the payroll tax.

SPECIAL CHARGES AND REBATES

In anticipation of the introduction of the special measures which the Chancellor of the Exchequer is empowered to make by this year's Finance Act the Commissioners of Customs and Excise have issued Notice No. 320 which explains the *modus operandi* of the system.

One section is devoted to purchase tax. It states that the special surcharge or special rebate will apply to all amounts becoming due on or after the operative date of introduction. Irrespective of the date of purchase or the contract for process, the date when the chargeable goods pass the normal tax point will govern the liability to adjustment. Methods of dealing with imported goods, invoices, accounts and "sale or return" and similar arrangements are specified.

Electricity Workers' Pay Claim

A claim for a substantial increase in wages for 120,000 workers in the electricity supply industry was discussed by the National Joint Council for the industry which met at Newcastle-upon-Tyne last week. No definite figure was given in the claim submitted to the Council by the four unions of which the men are members—the Electrical Trades Union, the Amalgamated Engineering Union, the Transport and General Workers' Union and the National Union of General and Municipal Workers. A spokesman for the Council said that the Council had referred the claim to its negotiating committee, which would meet in London to discuss it.

E.T.U. and T.U.C.

The inquiry by the Trades Union Congress into the affairs of the Electrical Trades Union began on Monday when members of the E.T.U. Executive Committee were interrogated for five hours by the Finance and General Purposes Committee of the T.U.C. General Council. The inquiry relates to allegations of ballot rigging and association with the Communist Party which were raised in the recent High Court action, and also to the decision of the Executive Committee of the Union to transfer certain powers from the secretary to sub-committees.

B.I.C.C. in Western Australia

In our issue of 30th June we made reference to B.I.C.C. participation in a cable factory project in Western Australia. British Insulated Callender's Cables, Ltd., say that this was almost certainly based on a document recently issued by the London office of the Government of Western Australia, entitled "Opportunities for Industrial Investment in Western Australia." On page 40 of this publication, under the heading "Major Industrial Projects—1960/1961," the statement is made that Cable Makers Pty., Ltd., valued at £A500,000, is a subsidiary of B.I.C.C.

The implication is that C.M.P. is wholly-owned by B.I.C.C., which is not so, though B.I.C.C. do perform the function of commercial and technical advisers. The matter is to be put right in any subsequent edition of the publication.

NEW ASSOCIATION

The South Eastern Electricity Commercial Association (S.E.E.C.A.), which has been set up to further the interests of the commercial staff of "Seeboard," has issued a bulletin which gives details of the proposed constitution. Further details can be obtained from Mr. D. G. Wilson, 128, Shepherd Street, Northfleet, Kent.

SWISS SECURE AMERICAN CONTRACT

It is reported from Los Angeles that Brown Boveri of Switzerland have secured a contract from the Board of Water and Power Commissioners for two turbo-generator sets valued at $8·8 million. Tenders of about $10 million had been submitted by C. A. Parsons & Co. and the General Electric Co. The lowest American bid was that of Allis-Chalmers amounting to $10·3 million.

Nigerian King Visits South Western Board

The Oba (King) of Lagos, Adele II, and his wife, the Olori, visited Electricity House, Bristol, on 25th July and were welcomed by the chairman of the South Western Electricity Board, Mr. A. N. Irens, and Mrs. Irens. The Electricity Corporation of Nigeria has close links with the electricity supply industry in this country. Posts with the Nigerian Corporation, on secondment, are now open to S.W. Electricity Board engineers on contracts of up to three years.

C.E.G.B. CONTRACTS

CONTRACTS amounting to over £9 million have been placed by the Central Electricity Generating Board during the past month for power stations, transmission lines and transforming stations. They include the following:—

Thorpe Marsh power station: Water treatment plant. — Neckar Water Softener Co. Main railway sidings.—Henry Boot & Sons (Railway Engineering).

Drakelow "C" power station: Main connections, Nos. 9 and 10 units.—British Insulated Callender's Cables. Structural steelwork, stage 11.—John Lysaght's Bristol Works. One 375 MW turbo-generator (No. 11), condensing, feed heating and evaporating plants and boiler feed pumps.—English Electric Co. One 375 MW turbo-generator (No. 12), condensing, feed heating and evaporating plants and boiler feed pumps.—A.E.I.

Bankside power station: Water treatment plant.—William Boby & Co.

West Thurrock power station: Structural steelwork for bunkers and framing for boilers 3 and 4.—Dawnays.

Stockport substation: 132 kV and 33 kV switchgear.—A.E.I.

Atherton substation: Two 60 MVA, 132/33 kV transformers and auxiliaries.—Yorkshire Electric Transformer Co.

Lower Darwen, Bromley Cross/Tottington, Blackburn substation: Modifications to Padiham and Lower Darwen 132 kV line terminations at Blackburn substation.—British Insulated Callender's Construction Co.

Cardiff East and West substations: 132 kV and pilot cables between substations; 132 kV cables at Cardiff East.—British Insulated Callender's Cables. Two 30 MVA, 132/11 kV transformers.—Brush Electrical Engineering Co.

Finchley substation: Two 30 MVA, 132/6·6 kV transformers.—Bonar Long & Co.

Barking substation: 275/132 kV transformers.—Ferranti.

Chessington substation: 132 kV switchgear.—A. Reyrolle & Co.

FUTURE OF TELEVISION

Proposals for the future development of television submitted by Pye, Ltd., to the Pilkington Committee were announced last week by Mr. C. O. Stanley, chairman of the company. They were that all new general services should be in bands IV and V on 625-line standards; existing general services (B.B.C. and I.T.A.) should continue as at present until the new services in bands IV and V were fully established; the remaining channels in band III should be allocated entirely to a comprehensive educational television service on 405 lines. Colour television could be broadcast in due course on 625-line standard in bands IV and V.

In practical terms these proposals would produce an additional B.B.C. service, an additional independent service, a "Pay-TV" service and an educational service. At the same time the early change-over from 405-line to 625-line definition would strengthen the competitive position of British firms in the export market.

Higher Telephone and Postal Charges

ON Monday the Postmaster General, Mr. Bevins, announced higher Post Office charges. He said that recent wage and price increases meant that he had to raise a further £25 million a year. Of this sum £16·5 million would come from the telephone service and £8·5 million from postal charges.

Changes to operate forthwith include an increase in the maximum exchange line telephone connection charge from £5 to £10. The maximum charge for removal of a telephone is to be raised from £2 to £3. Excess mileage rental is abolished; new subscribers are to pay an initial charge of £5 a furlong in excess of three miles and then the ordinary rental charge.

From 1st November the quarterly rental for exclusive residential service will be £3 10s instead of £3 and for a shared line £3 (£2 10s); for business lines the charges will be £4 and £3 10s, respectively. Rentals for private switchboards and extensions will be raised.

Postal changes to operate from 1st October include 6d more for parcels; a basic printed paper rate of 2½d instead of 2d, with rebates for large users; and an increase in the basic charge for newspapers from 2½d to 3d.

New E.D.A. Horticultural Film

Since the Electrical Development Association's film "Electricity in Your Garden" was first produced in 1956 it has been seen by more than three-quarters of a million people. Many advances have been made in electrical greenhouse equipment since that time and in the Association's latest film, "Electricity in Your Greenhouse," a Press preview of which was given in London this week, some of the latest applications of electricity which help the specialist gardener as well as amateur gardeners who have greenhouses are demonstrated. It was made in Mr. Roy Hay's well-known garden at Hurtmore, Surrey, and features his greenhouse, in which the electrical equipment has been installed. Heating, lighting, ventilation, watering and pest control are all automatic and soil warming is used extensively both in the bench and also in the greenhouse border.

The film, which is in colour, runs for ten minutes and is available in 35 and 16 mm sizes. It was produced for E.D.A. by Denwood Films, Ltd., and the commentary is given by Roy Hay. Copies are available on free loan from the Association, 2, Savoy Hill, London, W.C.2.

High intensity lighting, used to encourage growth and flowering during the winter months, is featured in this still from the latest E.D.A. film

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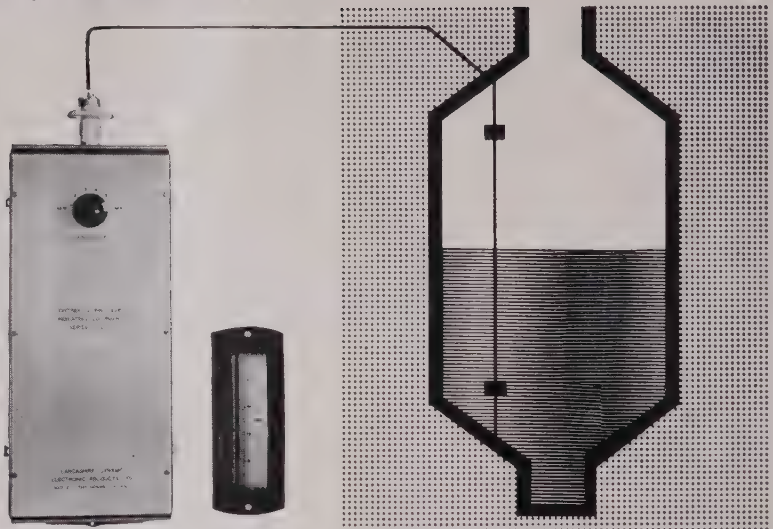

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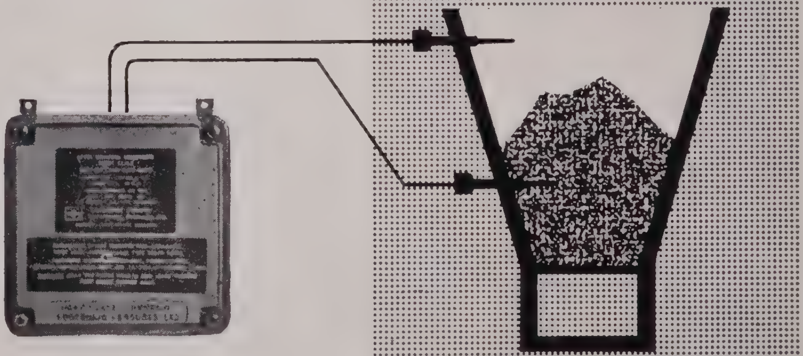

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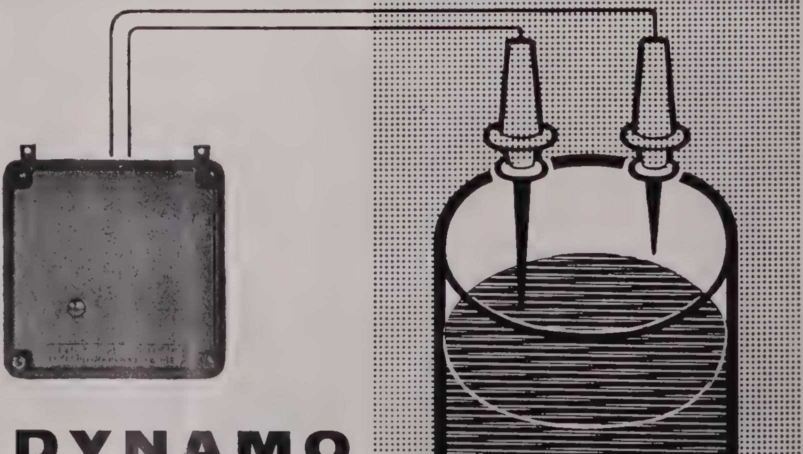

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ELECTRICITY AND FARMING

A FARMER who installs electrically operated equipment can save over £5 a week and many man-hours of labour. This, and other facts, are shown in two reports published by the Bristol University Department of Agricultural Economics and the South Western Electricity Board, who have carried out an investigation into the effect of electricity on farming. The reports are believed to be the first of their kind published in Britain. The project was approved by the Electricity Supply Industry's Utilisation Research Council who provided a grant for the investigation and four typical West Country farms where the farmers were willing to install mains electricity and to keep the necessary records, were selected for the experiments.

Direct comparison of running costs and labour needs before and after electrification are given in the reports and the overall effects on farm profitability of using electrical equipment are assessed. It is shown that privately generated electricity cost more than power supplied by the public mains. On one farm the Board supply costs just over 1¼d/kWh compared with 6d for private generation. Other facts which emerge from the report submitted to the Utilisation Research Council show that a farmer who changes from a petrol engine to an electric motor reduces running costs by up to £50 a year. The use of electrically operated equipment instead of a boiler fired by other fuels for sterilising results in savings of up to £30 a year in return for an increased investment of £170. It is also shown that by installing an electric pump £100 a year was saved in labour costs on one farm, while infra-red heat for pig rearing saved £30 a year in fuel costs and 390 man-hours of labour.

The report concludes: "Rural electrification is a costly process and relatively unremunerative to Electricity Boards. This report shows clearly how the many farmers already connected to the electricity mains and those now being afforded a public supply, can, by making a good and wise use of electricity, produce a worth-while return on their capital investment and at the same time help to make electrification pay its way."

Export Barometer

WE have already reported that the quarterly "Export Guide" which has been published by the General Electric Co., Ltd., for over four years, has been taken over by the London School of Marketing, Ltd., Newspaper House, Great New Street, London, E.C.4, which is to produce the Guide on a subscription basis. At a meeting in London last week Mr. Nicholas Stacey, economic and marketing adviser to the G.E.C., who has been responsible for the Guide, and Mr. Adam Johnstone, chairman of the London School of Marketing, explained the reasons for the change of ownership—mainly the desire to expand and develop the Guide under the auspices of an independent marketing body. Messrs. Stacey and Johnstone form an editorial committee.

The July issue of the "L.S.M. Export Guide" (which is being issued gratis) surveys the present position of sterling and possible future measures and includes an article on "The Outlook in Mexico." Four pages of charts in colour illustrate trends in trade by product groups and countries. This is supplemented by specific information about projects in overseas markets. The Guide forecasts prospects for the export of 36 British product groups to 34 countries. The outlook for the third quarter of this year is said to be "good" in 19 countries, "improving" in three, "unchanged" in four, "deteriorating" in six and "bad" in two (Ceylon and Venezuela). It is mentioned that the outlook for British exports has improved since April in France and the United States.

Approved Electrical Contractors

THE National Inspection Council for Electrical Installation Contracting (Aldine House, 10/13, Bedford Street, London, W.C.2), has produced a fifth edition of its Roll of Approved Electrical Installation Contractors. This gives the names and addresses, by counties, of over 5,400 firms and individuals whose work has secured the cachet of the N.I.C. There is also a complete alphabetical index and a guide to the constitution of the Council.

This time 22,000 copies have been printed, as against 20,000 last year, and over 18,000 of these are being circulated, mainly free of charge, to all county and local authorities and other interested public bodies, throughout the country. This year a letter has been sent with the copy of the Roll, addressed to the clerk of each council requesting that, unless his council already restrict their electrical installation work to approved contractors, the question of so doing be laid before the council. Copies are also sent free to approved contractors and other interested bodies and individuals. Various amendments of the rules relating to enrolment have been approved by the Board, and the third edition is now with the printers.

Between 1st April and 30th June this year 55 applications for enrolment were approved by the National Inspection Board; 13 applications were rejected and 71 were deferred for a further inspection; 28 firms were removed from the Roll, the majority of them because they have ceased to exist, or no longer participate actively in electrical contracting work; 95 new applications for enrolment were received.

Vacuum Casting and Encapsulation

Crompton Parkinson, Ltd., have ordered an epoxy-resin vacuum casting and encapsulation plant from Leybold-Elliott, Ltd. The plant, which will be the most advanced of its kind in the country, is designed to include a high degree of automatic operation. Epoxy-resins are used in the electrical industry for the impregnation and encapsulation of components. They are also used to replace other types of insulating materials.

BROOK MOTORS IN CANADA

Brook Electric Motors of Canada, Ltd., has moved into larger premises on the new trading estate area at Rexdale, near Toronto Airport. Behind the office frontage is a warehouse with 10,000 sq ft of floor space which will enable better stock service to be given and a wider variety of types to be made available. Some plant will be installed to enable limited modifications to be made for customers' convenience. Increasing business since the subsidiary was launched two and a half years ago has made this move necessary.

Electricity Output Rise Quickens

WITH an increase of 13·2 per cent in June, the rate of expansion in electricity output for the first six months of the year was brought up to 7·4 per cent. Though lower than in the corresponding period of 1960 (11·9 per cent), this was better than seemed likely in the early months of this year (in the first quarter the increase was 5·3 per cent). The Ministry of Power's monthly statement of electricity generated and sent out for public supply shows that 1·8 million tons more coal was used in power stations in January-June of this year.

The aggregate output capacity of the power stations of the Central Electricity Generating Board and the two Scottish Boards at 30th June was 30,323 MW, compared with 29,575 MW at the end of last year, an increase of 748 MW. The only major addition in June was a 120 MW English Electric turbo-generator with an 860 klb/hr John Brown boiler at the C.E.G.B.'s Belvedere H.P. station.

The second table shows the output of individual Boards to their consumers. For England and Wales the average increase was 13·2 per cent, but the Electricity Council states that, when corrected for weather and working conditions, the effective rise was 7·7 per cent. The greatest advance was again made by the two Scottish Boards, closely followed by Yorkshire and Merseyside & North Wales.

ELECTRICITY GENERATED AND SENT OUT FOR PUBLIC SUPPLY

	Fuel consumed Thousand tons			kWh generated Millions			kWh sent out Millions	Output capacity MW
	Coal	Coke and Breeze	Oil	Steam	Water power	Total		
Central Electricity G.B.	3,522	67	344	8,137	3	8,147	7,632	27,530
North of Scotland H.E.B. ...	1	—	1	3	155	162	161	1,045
South of Scotland E.B.	263	1	1	497	6	503	473	1,748
Total for June, 1961	3,786	68	346	8,637	164	8,812*	8,266	30,323
Corres. total for June, 1960	3,229	60	383	7,638	135	7,782	7,301	28,351
Inc. or dec., per cent	+17·2	+14·4	−9·7	+13·1	+21·7	+13·2	+13·2	+7·0
Total to date (6 months), 1961 ...	26,790	451	2,828	62,270	1,517	63,880	60,118	
Total for corres. 6 months, 1960	24,971	497	2,645	58,009	1,385	59,469	56,002	
Inc. or dec., per cent	+7·3	−9·3	+6·9	+7·3	+9·6	+7·4	+7·3	

* The total figure includes generation by other methods amounting to 11 million kWh.

ELECTRICITY SENT OUT BY BOARDS FOR THEIR CONSUMERS

Board	Totals for June (million kWh)			Twelve Months' Totals Ended 30th June (million kWh)		
	1960	1961	Inc. or Dec.%	1960	1961	Inc. or Dec.%
London	503·4	570·7	+13·4	8,429·9	9,247·3	+11·0
South Eastern	389·2	441·5	+13·4	5,905·8	6,573·8	+11·3
Southern	522·1	602·1	+15·3	7,784·7	8,876·5	+14·0
South Western	247·5	284·1	+14·8	3,631·2	4,066·5	+12·0
Eastern	638·8	699·5	+ 9·5	9,405·8	10,442·1	+11·0
East Midlands*	552·9	627·3	+13·5	7,833·8	8,641·8	+10·3
Midlands*	712·4	811·0	+13·8	10,331·8	11,358·5	+ 9·9
South Wales*	448·5	485·2	+ 8·2	5,749·0	6,160·7	+ 7·2
Merseyside and N. Wales* ...	456·3	529·8	+16·1	6,081·7	6,768·8	+11·3
Yorkshire*	737·8	861·9	+16·8	10,031·6	11,539·3	+15·0
North Eastern*	423·1	470·2	+11·1	5,765·4	6,378·9	+10·6
North Western*...	714·3	825·4	+15·6	10,058·4	11,245·3	+11·8
Total all Area Boards	6,346·3	7,208·7	+13·6	91,009·1	101,299·5	+11·3
Direct Supplies by C.E.G.B. ...	298·9	314·9	+ 5·4	3,691·9	3,819·6	+ 3·5
Grand Total	6,645·2	7,523·6	+13·2	94,701·0	105,119·1	+11·0
Mainly Industrial Areas* ...	4,045·3	4,610·8	+14·0	55,851·7	62,093·3	+11·2
Mainly Non-Industrial Areas ...	2,301·0	2,597·9	+12·9	35,157·4	39,206·2	+11·5
South of Scotland E.B.	519·0	607·1	+17·0	7,524·6	8,503·5	+13·0
North of Scotland H.E.B. ...	112·6	131·6	+16·9	1,698·3	1,675·4	− 1·3

* Those in which industrial consumers took over 50 per cent of the total sales in the preceding financial year.

MORE ELECTRICAL APPLIANCES IN BRITISH HOMES

According to a report issued this month by the magazine *Woman,* two out of every five British housewives now have washing machines, twice as many as in 1956. Owners of refrigerators, hair dryers and sewing machines with electric motors have more than doubled during the past five years, while owners of electric steam irons have trebled. There has also been a striking increase in the ownership of immersion heaters, television receivers and vacuum cleaners. The report, which was based on a nation-wide survey conducted by the Odhams Press Research Division, was carried out between January and March this year and involved interviews with more than 4,000 housewives.

TRADE ANNOUNCEMENTS

On 8th August the **Morphy-Richards Service Division,** which services the products of Morphy-Richards (Cray), Ltd., Morphy-Richards (Astral), Ltd., and Morphy-Richards (Installations), Ltd., is opening new headquarters comprising administration centre, depot and central store on the Industrial Estate, Weedon Road, Northampton. A service depot for S.E. England will remain at St. Mary Cray. A new main London service depot has been set up at 29/31, Scrutton Street, Shoreditch, London, E.C.2 (telephone: Shoreditch 6941).

Under a reorganisation of the sales territories of the **Desoutter Group** Mr. K. F. Tunnicliff has joined the Midlands staff operating from the Birmingham office. In the North East of England Mr. E. Machan has replaced Mr. J. Fox who has been transferred to North East London to take over from Mr. C. L. Startup, who has retired. Mr. P. C. Botting is to be responsible for the Central London area.

On 1st August the Nottingham branch of **Mayall & Co., Ltd.,** is moving to new premises at 3, Plumptre Street (telephone: Nottingham 52689). Mr. R. W. Walker is the branch manager.

Matthew Hanna & Co., of 86, Great Victoria Street, Belfast, have been appointed Northern Ireland agents for the **Metallic Seamless Tube Co., Ltd.,** of Birmingham.

A new depot at Studd Green Works, Elworth, Sandbach, Cheshire (telephone: Sandbach 986), has been established by **Henry Sykes, Ltd.,** for the sale, hire and servicing of their range of pumps, winches and pile driving equipment.

Wayne Kerr Laboratories, Ltd., have appointed Mr. B. W. Morgan as sales engineer for North West London and surrounding areas.

The works of **Transformers (Watford), Ltd.,** will be closed from 11th to 28th August for the annual holidays.

Nuclear Power Questions

A SERIES of written questions on atomic energy matters were put to the Parliamentary Secretary for Science, Mr. Freeth, by Mr. Carr last week. He asked first to what extent there had been an increase in the volume of design work on reactor systems and other plant respectively placed in the past year with industrial firms by the Atomic Energy Authority.

Mr. Freeth said the volume of design work on reactor systems and other plant associated with the civil nuclear power programme carried out by the industry on behalf of the Authority was at the same level in 1961-62 as it was in 1960-61.

The second question concerned the amount received by the A.E.A. from the sale of fuel elements. Mr. Freeth said the Authority received £2 million from the sale of fuel elements in 1960-61 in addition to the £6,500,000 advance payments received in 1959-60. They expected to receive £13 million from fuel element sales in 1961-62. Deliveries of fuel elements for the civil nuclear power stations were being made in accordance with the delivery schedules between them and the electricity generating boards.

Mr. Carr then asked to what extent the fuel canning lines at the A.E.A. factory at Springfields were now employed. Mr. Freeth said that the three completed fuel canning lines were fully employed and that all five lines were expected to be in production by May, 1962. The factory would then be capable of meeting all demands now foreseen for Magnox canned natural uranium fuel elements. It would be necessary in due course to plan new facilities for the fabrication of uranium oxide fuel elements, if it was decided to include power stations using such elements in the nuclear power programme. The planning of the facilities would not, however, be necessary before 1965-66. Only preliminary discussions had therefore yet been held with the C.E.G.B. and the consortia about the possibility of manufacture of the elements outside the Authority.

Replying to further questions, Mr. Freeth said that the number of professional staff employed by the Authority on design studies and research and development for the prototype fast reactor was 350 now compared with 200 a year ago. The time at which full design and construction of a prototype commercial reactor could begin depended on the progress made in developing a suitable fuel.

The proportions of total professional staff engaged on civil research and development, working on main reactor systems in 1960 and 1961, respectively, were: Magnox reactors 20, 15; advanced gas-cooled reactors 20, 20; fast reactors 9, 14; and high temperature gas-cooled reactor 8, 8. Exploratory work and design studies were being undertaken on the steam-generating heavy water reactor and on marine reactors. In their general work on reactor technology, the Authority were devoting some effort, including work on experimental physics, to keeping abreast of developments abroad on other reactor systems.

Mr. Carr asked what work was now being undertaken by the A.E.A. on the development of plutonium fuel elements for the fast reactor, to what extent work on plutonium had increased in the past year, to what extent development had been held up by the shortage of plutonium, and when the Dounreay fast reactor was expected to start operation with plutonium fuel elements.

Mr. Freeth said the A.E.A. had in hand an intensive programme on the development of plutonium fuel elements for the prototype fast reactor. The fuels included mixed plutonium and uranium dioxides in steel matrix and mixed plutonium and uranium carbides. The fuel development involved the preparation, irradiation testing and examination of specimen fuel materials, the investigation of methods of making complete fuel elements and their irradiation testing, and the investigation of the behaviour of fuel elements under conditions simulating those expected to be experienced in a power reactor.

Prestcold Showroom at Oxford

A new showroom for the Prestcold Division, Pressed Steel Co., Ltd., was formally opened on 10th July at St. Giles, Oxford. The branch will be a centre for the sales of commercial refrigeration equipment and the distribution to retailers and Electricity Boards of household refrigerators and other domestic products yet to be announced. Its operational area will be Oxfordshire, Wiltshire, parts of Berkshire, Dorset, Hampshire, Gloucestershire and Somerset. The manager of the branch is Mr. J. D. Roberts.

Solartron's New Headquarters

THE main administrative, research, development and electronics manufacturing centre of the Solartron Electronic Group, Ltd., is now housed at Farnborough, Hampshire, following the completion of phase II of their five-year £1¼ million building programme. Phase I consisted of a 50,000 sq ft workshop area and a single-storey administration section. Phase II comprises a five-storey block of 35,000 sq ft and 70,000 sq ft of production floor space, and was officially opened by the Rt. Hon. Reginald Maudling, President of the Board of Trade, on 17th July. Phase III of the building plan should be ready by the autumn of 1963 and phase IV, which will double the existing factory area, by 1965/66.

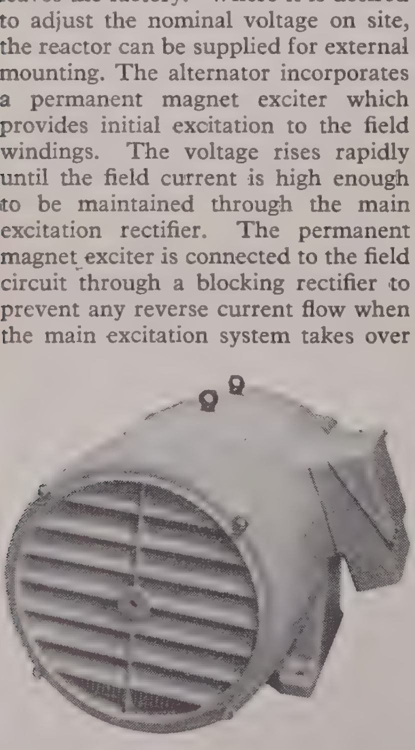
The contractors for the new office block and factory extension were Taylor Woodrow Construction, Ltd. An interesting feature on the front elevation of the office block is the architects' impression of an electronic wave form. It consists of a white rendered concrete panel, about 25ft long and 8ft high, the design of which is made up of coloured mosaic tiling.

General view of the new Solartron office block

NEW ELECTRICAL EQUIPMENT

SELF-EXCITED ALTERNATORS

The Stamford "L" range of self-excited alternators announced by Arthur Lyon & Co. (Engineers), Ltd., Park Works, Stamford, Lincs., incorporate a static system of self-regulation with a pre-set reactance to provide practically constant voltage under all conditions. Low overall dimensions and weight have been obtained by the use of class "E" insulation in the stator and class "B" insulation in the rotor. The voltage is maintained within the limits of ± 2½ per cent for all variations of load between no load and full load, changes in power factor from unity to zero lagging, and variation in driving speeds within 4 per cent as specified in B.S. 649. The transformer rectifier voltage compensating circuit incorporated is supplemented by an additional reactor which reduces the effect on the output voltage due to changes in temperature. All the control equipment is housed within the frame. The reactor is provided with adjustment to enable the output voltage to be pre-set to the required level before the machine leaves the factory. Where it is desired to adjust the nominal voltage on site, the reactor can be supplied for external mounting. The alternator incorporates a permanent magnet exciter which provides initial excitation to the field windings. The voltage rises rapidly until the field current is high enough to be maintained through the main excitation rectifier. The permanent magnet exciter is connected to the field circuit through a blocking rectifier to prevent any reverse current flow when the main excitation system takes over the field supply. All windings are tropically impregnated and the rectifiers are rated for use in ambient temperatures up to 65°C. When machines are required for use in ambients exceeding 40°C the de-rating called for in B.S. 2613:1957 must be made. For parallel operation, means can be provided for quadrature droop compensation. This takes the form of an adjustable choke connected across the output of a current transformer, which gives the machine a drooping characteristic with increases in reactive load. Alternators in the "L" range are available as three-phase machines only in five basic frame sizes covering output ranges of 97·5 kVA to 250 kVA, 50 c/s, 1,500 r.p.m.; 65 kVA to 165 kVA, 50 c/s, 1,000 r.p.m.; 115 kVA to 300 kVA, 60 c/s, 1,800 r.p.m.; and 77·5 kVA to 200 kVA, 60 c/s, 1,200 r.p.m.



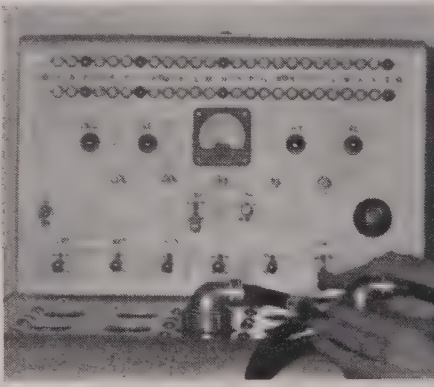
Arthur Lyon Stamford "L" range alternator

MINERAL-INSULATED THERMOCOUPLES

A new process is used in the production of earthed and insulated hot junctions which are now available from Spembly, Ltd., New Road Avenue, Chatham, Kent, with sealed earthed junctions in cable sizes down to a diameter of 0·010in. Insulated and sealed hot junctions can be produced in cables down to 0·020in diameter at present, but developments should extend the range down to 0·013in diameter in the future. The process depends essentially on a new welding technique developed from the standard Spembly capacitor discharge welding equipment. Basically, capacitors are charged to the correct voltage to cater for length and conductor resistance. They are then discharged through argon, which has been ionised by a high-frequency field, to form the insulated hot junction inside the cable end. The thermocouple is also capped by a similar process, which produces a vacuum-tight weld with no increase in the overall diameter of the cable.

MULTICORE CABLE TESTER

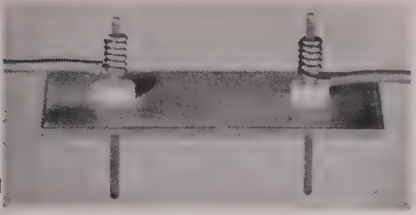
An automatic apparatus for testing the continuity of conductors in multicore cable, and leakage between cores, and between cores and the screen has been developed by P.C.A. Radio, Beavor Lane, London, W.6. It comprises two rotary selector switches, driven by solenoids. On the satisfactory completion of one test the solenoids operate to step the selector switches to the position connecting the next core of the cable. Indicating lamps are fitted, one for each core of the cable to be tested, showing when a test is being carried out and if a fault has occurred on that core. During continuity tests some 50 V is applied to each core in turn, but for leakage tests the cores are energised from a 500 V d.c. supply. The tester may be set to detect leakage up to 100 MΩ. The apparatus includes a potentiometer for controlling its sensitivity and a microammeter which can be switched by a pushbutton into circuit to enable the leakage current between cores to be read. Plessey brass type Mk.IV plugs and sockets are used, but any types of plugs and sockets can be supplied.



P.C.A. Radio multicore cable tester

SOLDERLESS WIRE CONNECTION TERMINALS

Solderless wire connections may now be made utilising Sealectro "Press-Fit" p.t.f.e. terminals. The development is announced by the Sealectro Corporation, Hersham Factory Estate, Walton-on-Thames, Surrey, and is made available through the introduction of part No. FT-WJ-100 feedthrough terminal. This is rectangular in shape, with truncated circular ends. The chassis is prepared with a punch, forming a rectangular shape with bevelled entrance. The



Sealectro solderless wire connection terminals

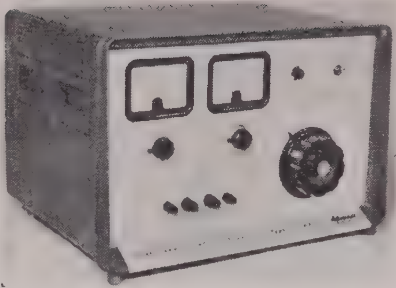
terminal, when pressed in and properly seated, provides extremely high torque resistance.

The stud is rectangular with prescribed cross-section configuration for optimum contact and mechanical holding power on the wire. The unit has 1·2in overall height, with a lug above the chassis of 0·460in, and below 0·459in. The cross-section of the lug is 0·045in by 0·036in.

TRANSISTORISED POWER SUPPLIES

Two more instruments have been added to the range of laboratory power supplies manufactured by **Advance Components, Ltd.**, Roebuck Road, Hainault, Ilford, Essex. These are the types P.P.2 and the P.P.4. Identical in appearance, both instruments give full overload protection both to the instrument and any connected loads or supplies. Both are transistorised. The P.P.2 provides any required d.c. output from 0 to 50 V up to a maximum current of 10 A and the P.P.4 from 0 to 80 V at currents up to 6 A. The incorporation of a "Volstat" constant voltage transformer ensures a high stability of output voltage while protection against either progressive or instantaneous overloads is provided by an electronic trip circuit which operates within 0·2 msec of an overload occurring.

An overload protected two range voltmeter and an ammeter switched to provide four current ranges, give continuous monitoring. The current selection switch automatically adjusts the overload trip circuit to operate at 150 per cent of full scale deflection. Heat dissipation is effected by an air-blower and a thermal cut-out gives protection against internal temperatures in excess of 70°C.



Advance Components transistorised power supply unit

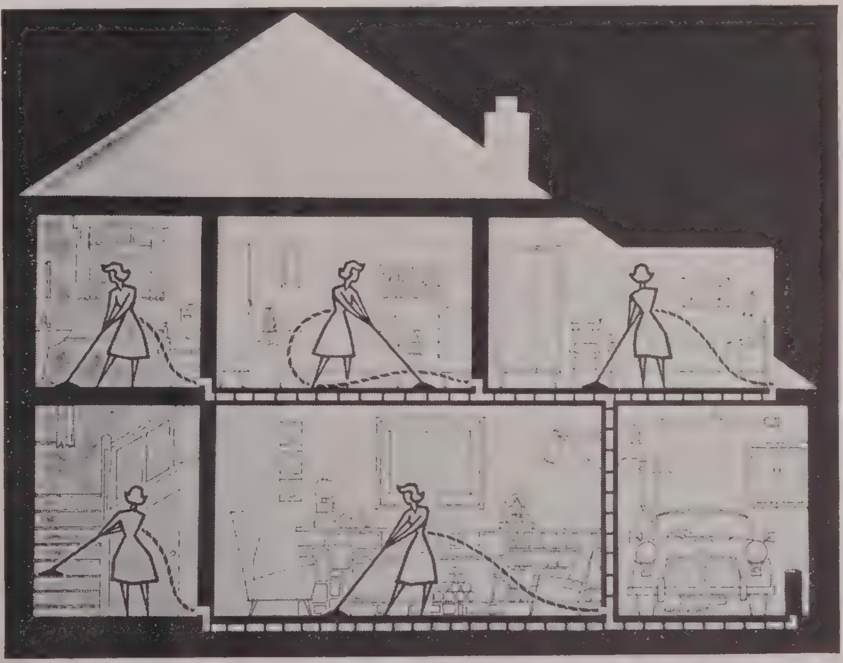
The output resistance is less than 3 mΩ, the impedance less than 0·2 Ω to 100 kc/s and the ripple less than 1 mV peak-to-peak. The instruments will operate at full load in ambient temperatures up to 35°C. Input voltage variations of ±15 per cent of nominal are permitted, the stabilisation factor being 5,000 : 1.

Domestic Vacuumation Plant

A small vacuumation unit, suitable for domestic purposes, has been introduced by **Goblin (B.V.C.), Ltd.**, Goblin Works, Leatherhead, Surrey. Though new to the domestic field, vacuumation has been used in industry and for public buildings for more than 60 years. A few houses are now being equipped in this way, state the manufacturers, and it is expected that more will follow as the plant required becomes available. A three- or four-bedroomed house can be fitted with this built-in cleaning system at a reasonable price—a complete installation may well cost less than £100.

A master switch in the kitchen, fitted with a pilot light, makes vacuum power available all over the house. Instead of a cleaner being carried from room to room, lightweight plastic hose, with tools designed for most cleaning jobs in the home, is plugged in to flush-fitting sockets in the walls or floors. Powerful suction carries away all the dirt and dust through plastic or steel pipe-lines set under the floors. The air stream conveys it to a container underneath the vacuumation unit, which can be installed in a cellar, boiler room, garage or outhouse. This container needs only infrequent emptying and the dirt can be disposed of without undue mess.

For blocks of flats or for private houses with divided accommodation, plants giving self-contained cleaning systems for each occupier can be planned to operate from a single power unit. It is difficult to estimate the exact cost of installation; this is, of course, less when the house is in course of construction. Although B.V.C. are prepared to install the vacuumation plant, it can be done by local builders or plumbers.



Sectional sketch showing a B.V.C. vacuum plant installed in a house

E.T.U. OPPOSES WAGE RESTRAINT

THE Electrical Trades Union made it clear at its policy conference at Portsmouth last week that it would fight any form of wage restraint. Delegates unanimously passed a resolution pledging the Union to seek a "substantial increase" for all electrical workers. "The situation now is that the offensive by the Government against wages is gathering momentum," said Mr. R. G. MacLennan, acting assistant general secretary. It was setting an example first with the teachers and the Post Office engineers. "Our members are going to face the same problem in the State-owned electricity supply industry," he said.

The Conference carried a resolution calling for a nation-wide campaign to make the public aware of the hazards to which they could be exposed in hospital as a result of the Ministry of Health's refusal to recognise that electrical services required particular safeguards. Another resolution, which was also carried, referred to "hazards which face patients through lack of trained electrical staffs being available at all times," and urged that only electricians should deal with maintenance and faults.

Mr. J. P. Smith, a London Electricity Board installation inspector, said that at night when electricians had gone off duty, millwrights and plumbers dealt with the installations.

The Conference accepted a composite motion on apprenticeship training which stated that neither the employers nor the Government were facing up to their responsibilities to plan for the increasing numbers of young people entering industry. It requested the Union Executive to arrange comprehensive apprenticeship agreements in all industries with which they were associated to ensure a proper ratio of apprentices to journeymen, adequate technical training up to the age of 21 and the interchange of apprentices between employers.

Mr. J. T. Byrne, the new general secretary, said the Executive supported the motion and declared that it was essential, in addition to calling on the Government and and T.U.C., that they themselves should play a full part in those things and not shed their responsibilities. "For far too long we have been content to put motions on the agendas and leave the Government and the T.U.C. to deal with them when we ought to be doing the job ourselves."

A resolution was passed congratulating the Executive and national negotiators on securing an increase of 1s an hour for members in electrical contracting. Mr. Seymour Moss (London) said that if not asking for a wage increase for 2½ years was not wage restraint, he did not know what was. They had got the shilling but had lost some site allowances under which some men were getting £2 or more.

Replying for the Executive, Mr. MacLennan said the shilling an hour increase meant that their members had been to some extent cushioned against the wage freeze policy of the Government. It was a momentous agreement in the history of the Union.

Equal pay was debated on a composite motion. It demanded a full and vigorous campaign for equal treatment for all women workers.

In a private session, Conference upheld the decisions of the Executive Council and ruled that the general secretary should carry them out. These decisions were that Mr. John Byrne must obey the Council's instructions on staff changes; a sub-committee would be set up which would be responsible for conducting the Union's journal, *Electron*; Mr. Leslie Cannon and Mr. Frank Chapple, whom Mr. Byrne had appointed as his personal assistants, would be dismissed; and Mr. J. Humphrey, whom Mr. Byrne had suspended on full salary as office manager, would be restored to his position.

The resolution, which was carried by 216 votes to 145, read in part: "Conference having noted the judgment of Mr. Justice Winn and the decision of the Trades Union Congress to set up an inquiry into the Union's conduct and administration believes that in the interests of the Union the Executive Council should fully assume their powers under the rules."

PERTH'S ALL-ELECTRIC CITY CENTRE

THE electrical installation of Perth's new City Centre, which was officially opened on 21st July, was designed to make full use of off-peak electricity. The City Centre, which is the first of its kind in the North of Scotland Hydro-Electric Board's area, comprises 11 shops at ground level with a covered arcade on three sides, and the first and second storeys accommodate 23 flats, four private offices, and a large suite of offices for the Inland Revenue.

The estimated after-diversity maximum demand for the complete scheme is 375 kW off-peak and 300 kW normal tariff. A substation compartment was provided by Perth Town Council on the ground floor of the main building. This substation is equipped with a 4-panel 11 kV switchboard (A. Reyrolle & Co., Ltd.), two 750 kVA 3-phase, 11 kV transformers (Dennis Ferranti & Co., Ltd.), and a two-section l.v. board (Bonar Long & Co., Ltd.).

Supply is afforded from a central switchroom adjacent to the substation. The l.v. switchboard, manufactured by Ottermill Switchgear, Ltd., has a section for normal tariff supplies controlled by an 800 A isolator and two off-peak sections controlled by 300 A isolators. Supply to the normal tariff section is provided from the l.v. board in the Board's substation by two 0·25 sq in p.v.c. armoured cables in parallel. From the l.v. board in the substation two 0·25 sq in p.v.c. armoured cables are taken via 300 A contactors (Lancashire Dynamo Nevelin, Ltd.) to the off-peak sections in the l.v. switchroom.

All 27 houses have underfloor heating of Panelec design in the hall and living room where Satchwell air thermostats control room temperatures. Hot water requirements are met by a 50 gallon cylinder with a 2·5 kW Santon type immersion heater connected to the off-peak supply. Belling 47 AB cookers are installed in the kitchenettes and each living room is fitted with a 2 kW inset fire of the same make.

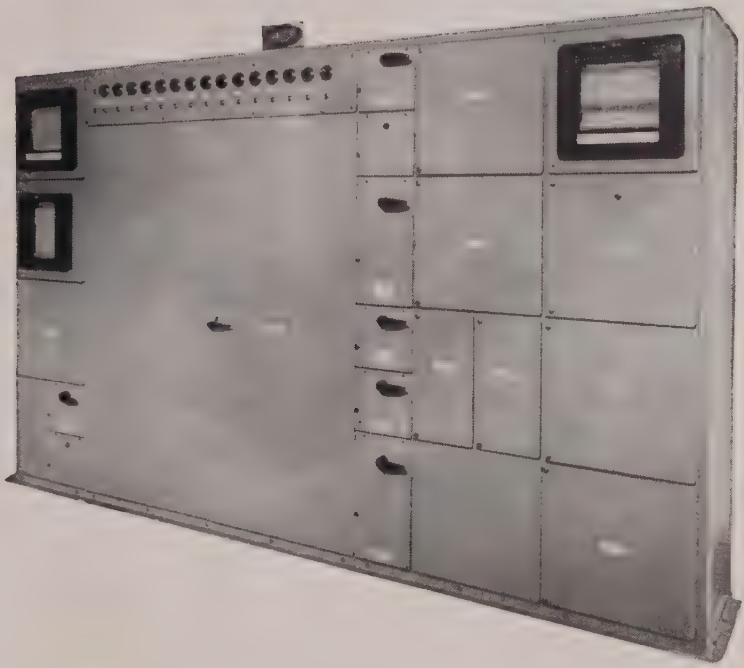
Wash-day drying facilities are provided for the tenants in six drying rooms on the first floor, each equipped with a 5 kW Copperad convector heater fed through a prepayment meter, and the drying installation includes a 15in Woods window-mounted extraction fan.

The main off-peak load is taken by the large suite of Inland Revenue offices and amounts to 140 kW of underfloor heating. Each office has a Satchwell wall-mounted thermostat but the charging period for the complete installation is determined by a McLaren thermal control unit mounted out of doors.

The four private offices are heated by block storage heaters with a total loading of approximately 26 kW. The charging period in this case is controlled by a Venner time switch in each office. Heatrae storage water heaters are installed in the offices and shops. The 11 shops have 13 A flush mounted socket outlets in addition to the off-peak circuit.

The architects for the City Centre are Mr. H. G. West in association with Mr. R. E. G. Miller who won first prize and the contract in an all-Scotland competition.

VARILECTRIC cubicle switchboards



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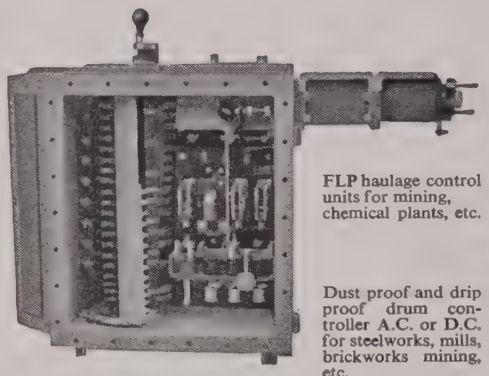

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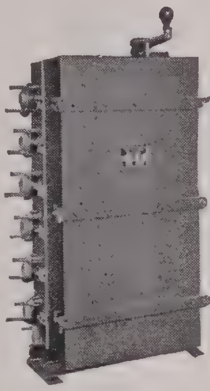

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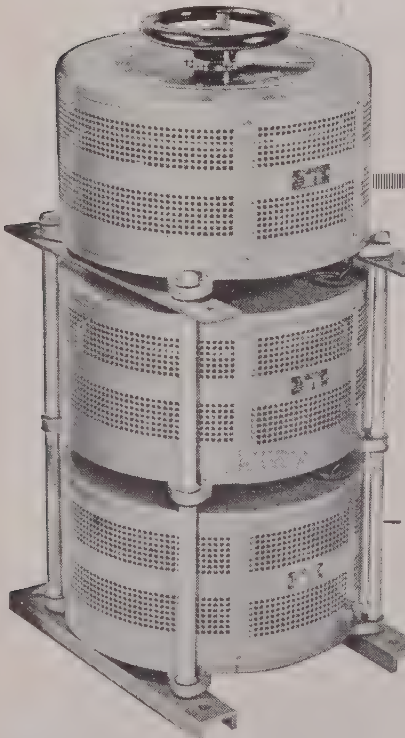

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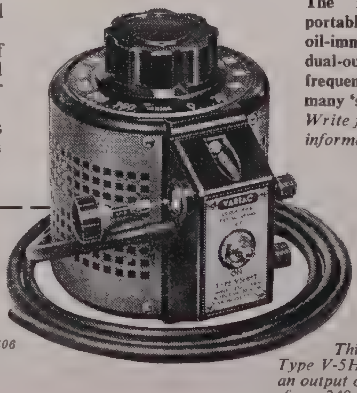

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TERMINATIONS FOR ALUMINIUM WELDING CABLE

Flexing Tests on Compression Applied Ferrule

By **D. E. JORDAN**, A.M.I.E.E., G.I.Mech.E.* and **J. F. HAGGITT**, A.C.T.(Birm.)†

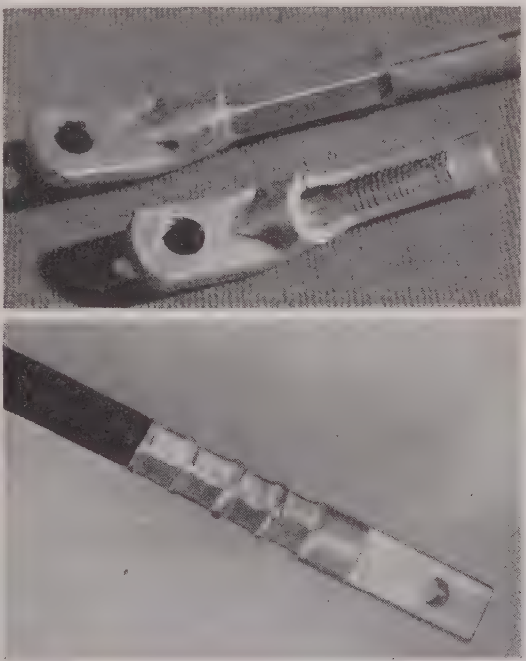
ALTHOUGH in some cases the life of a welding cable is not governed by the terminations but by the conditions under which it is used, it is often much shorter than it would be if the terminations were both electrically and mechanically efficient. With mechanical connections where two grub screws hold the cable in place, fatigue failure often occurs at the ferrule entry and the electrical connection is uncertain. Soldered connections are more durable and have better electrical properties, but they are still prone to fatigue trouble, and soldering can give poor results if the workmanship is indifferent. The compression type of termination for aluminium cables has been extensively studied by Aluminium Laboratories, Ltd., of Banbury, in connection with cables for the aircraft industry, and the results of these investigations show that a similar termination is suited to welding cables.

The new termination developed for aluminium aircraft cable consists of an aluminium ferrule applied by the compression technique using a split-hexagonal die. The ferrule is initially round in section and the bore is tapped with a fine thread, full depth of cut not being made. It has been found by experiment that this thread ensures a better initial electrical contact. The ratio between the cross-sectional areas of metal in the ferrule and cable should be at least 1·5 : 1, this ratio increasing as the cable size decreases, but in any case it is essential to see that the ferrule diameter is not greater than 1·22 times the width across the flats of the final hexagonal shape, since otherwise die-flash would be formed upon compression. The design of the split-hexagonal die must be such that the reduction in total cross-sectional area of the ferrule and conductor strands is between 10 and 15 per cent. This value has been found empirically to give satisfactory results although the actual degree of compression upon the cable would be difficult to determine owing to the longitudinal extrusion that occurs during compression.

A vital feature of the design is the length of the hexagonal compression upon the ferrule, since terminations of a similar type but using a single short hexagonal compression have been found to give unsatisfactory service. This length of compression should be at least six times the average wall-thickness of the ferrule after the joint has been made. Another feature contributing to the mechanical ruggedness of the joint is the insulation grip provided by a counterbore in the ferrule. The counterbored portion should not be less than ½in long with a minimum wall-thickness of 0·06in, and the bottom chamfered off at 45°.

While these terminations are undoubtedly suitable for welding cables they have the disadvantage that a high-compression tool is required for fitting them. Similar results, however, are obtained when the compression consists of three short hexagons, plus one for the insulation grip, provided that they are applied in a particular order. Of the three compressions making up the cable joint the outer ones must be made first, since these restrain the longitudinal extrusion when making the central compression, and a more compact joint is formed. The pressure required to operate these short dies is such that the work can be carried out in an ordinary bench vice.

Welding cables fitted with these new terminations have been subjected to both laboratory and workshop tests. The laboratory tests comprised flexing the specimen terminations for a number of cycles. For comparison, soldered aluminium and soldered copper terminations were included. The specimens had 4½in of free conductor between the terminations on either end, and the flexing



Top : Long hexagonal compression termination applied to an aircraft cable. The sectioned connector shows the thread in the bore and the counterbored portion for gripping the insulation. Bottom : New welding cable termination was produced by connecting one end of each to a cam mechanism which deflected them through an amplitude of 1in at a rate of 550 cycles/min.

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* Electrical Engineering Investigator, Aluminium Laboratories, Ltd.
† Alcan Industries, Ltd.

The soldered specimens were examined every $7\frac{1}{2}$ min (approximately 4,000 cycles) to record the rate of strand failure, but with the compression terminations intermediate inspections were not possible, since it would have been necessary to break the insulation grip to gain access to the cable strands, thus partially destroying the joint. To overcome this difficulty the individual specimens of a series were run for varying periods up to 24 million cycles to provide a table of results.

With the soldered copper terminations strand failure began after an average of 20,000 cycles, the value for the worst specimen being 15,000 cycles, and that for the best, 60,000 cycles. Of the six soldered aluminium terminations tested, two began to break down after about 100,000 cycles and of the remaining four two were still undamaged after 850,000 cycles. One of each of the six specimens fitted with the new terminations was removed from the test apparatus after periods of $\frac{3}{4}$, $1\frac{1}{2}$, 3, 6, 12 and 24 million cycles respectively, and of these all but the last were intact. With the 24 million cycle specimen only one strand was found to be fractured, the break being about $\frac{1}{8}$in inside the compression joint. During these tests a slight increase was noticed in the electrical resistance of the sixth specimen. The value rose from 88 $\mu\Omega$ at the commencement of the test up to about 100 $\mu\Omega$ after the 24 million cycles. Such a slight and gradual increase is not likely to be a manifestation of the onset of joint failure and it was probably due to work-hardening of the aluminium, which would increase its resistivity.

The practical tests were carried out in the welding workshops of Alcan Industries, Ltd., at Banbury, in which the terminations were in continuous 24-hour use for a full year.

THE UNIVAC COMPUTER

LAST week we attended the first demonstration in this country of the Remington Rand Univac Solid State 80 computer, which is a fully buffered computing system. The demonstration, an integrated data-processing job, took the form of a complex electricity billing operation. The demonstration showed the computer's ability to perform six operations simultaneously. It can calculate kWh consumption from meter readings. It can also integrate the meter readings when more than one tariff is concerned, break down the overall consumption by the agreed tariff blocks, calculate the several consumption block charges and arrive at a total to be charged. The machine also relates the present consumption on a per tariff basis with that for the previous corresponding quarter. Testing is performed by ascertaining that year-to-year variations in consumption fall within the agreed limits of ±20 per cent.

Consumption and charges figures are accumulated for analytical purposes according to the required parameters, i.e. by tariffs, by number of rooms, by trades, and by types and classes of appliances bought or used. Consumers' bills are printed at a rate of 600 lines of 130 characters per minute. Red/black printing is optional. Finally basic consumer records are automatically up-dated.

During this operation the computer produced standard electricity bills of 6 to 8 lines average (each with two counterfoils) at the rate of 78 per minute. The computer dealt with accounting problems varying from single meter/single tariff cases to multi-meter/multi-tariff operations and dealt simultaneously with hire-purchase, simple hire, maintenance, credits and other fixed charges. The Univac tested consumption of electricity for plausibility, and in the case of unread meters, estimated and charged the appropriate consumption. To cope with this and still permit the indicated print-out speed, the computer accepted detail input cards at the rate of 450 per minute and punched out up-dated file information at 150 cards per minute. Since statistical information is up-dated daily when bills are produced there is no " end of the period " peak load.

MEASUREMENT AND CONTROL

A new monthly journal entitled *Measurement and Control* is to be launched next January by Iliffe Production Publications, Ltd. The editor-in-chief is Mr. P. J. Farmer, A.F.R.Ae.S., who will continue as editor of the successful Iliffe quarterly *Data Processing*.

The Univac computer

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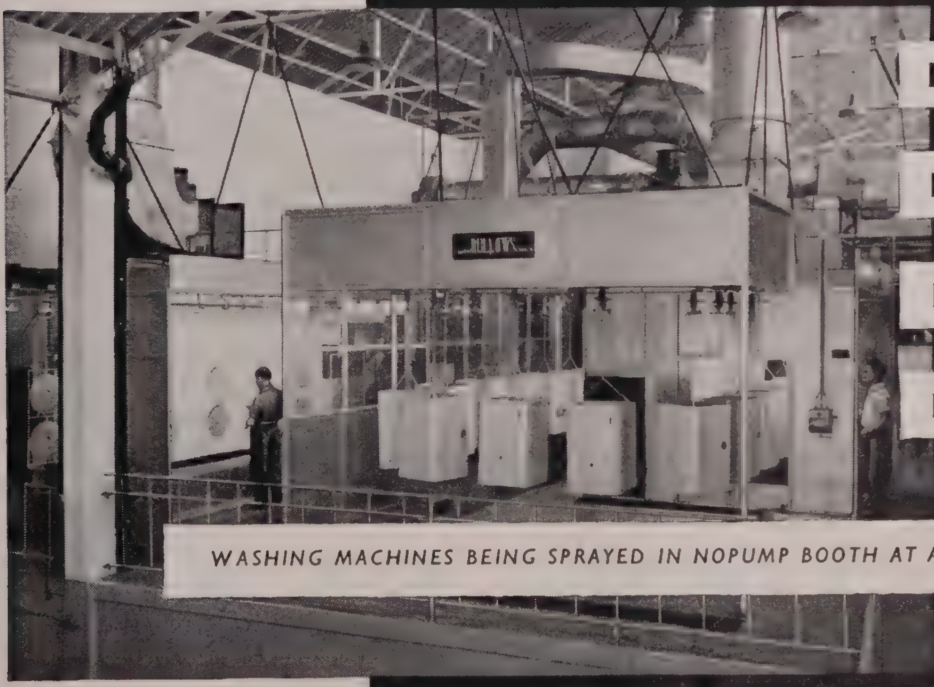

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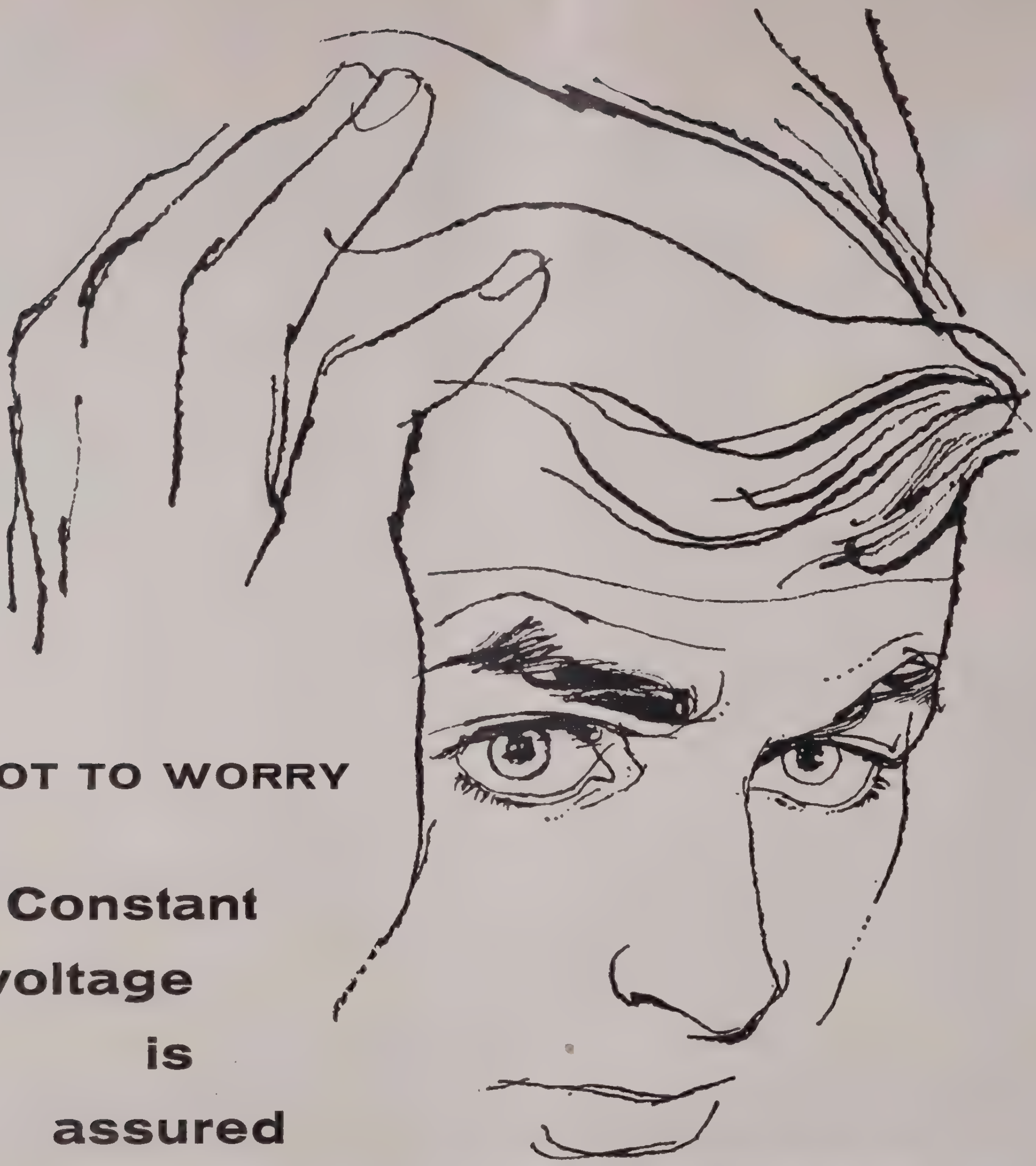

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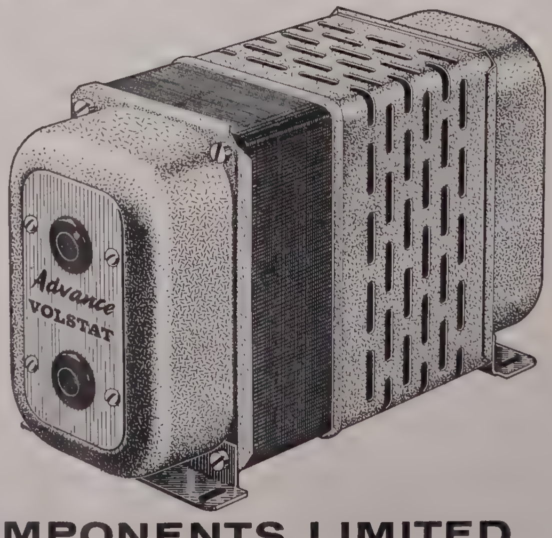

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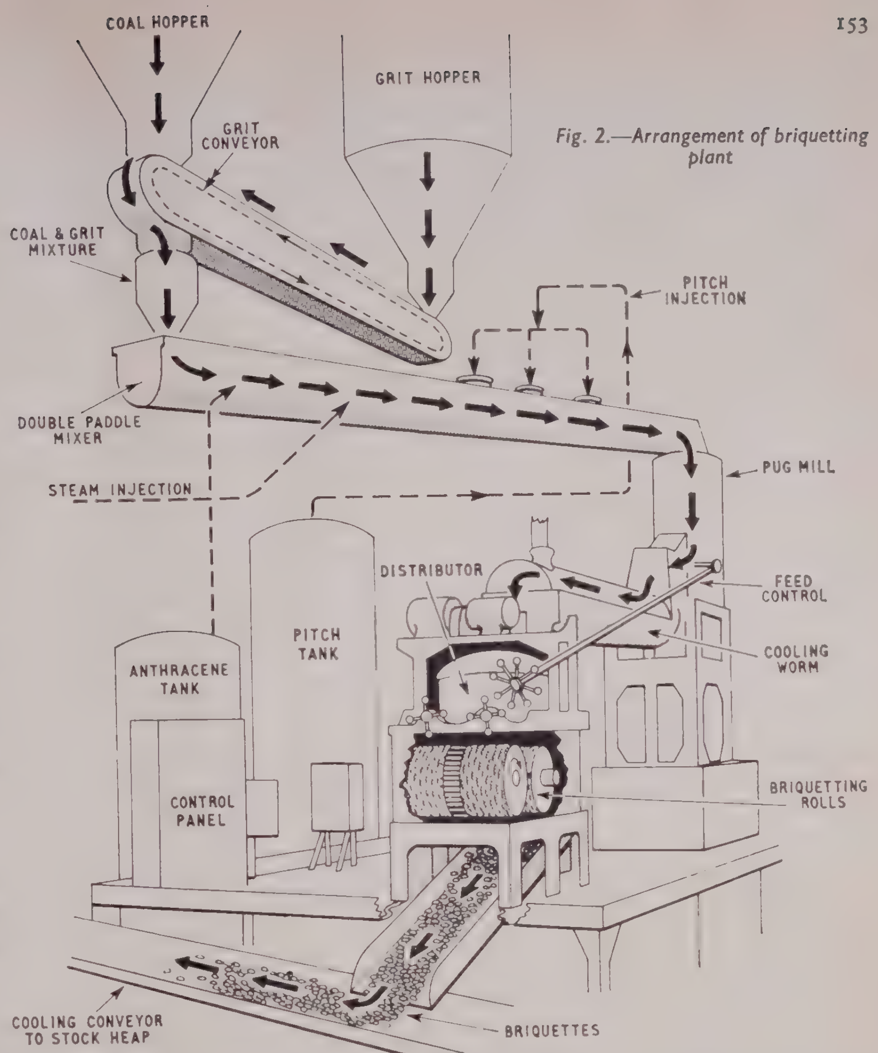

Fig. 2.—Arrangement of briquetting plant

KINGSTON power station, which was commissioned in 1948, was designed to burn North-East Coast small coals. The cost of this type of fuel is now 0·74d/kWh whereas the actual current fuel cost at Kingston is 0·54d/kWh. This reduction is a result of combustion and engineering developments which have been in progress since 1953 with the object of combating the rise of coal costs by burning lower grade fuels and briquetting chimney grits.

The composition of the fuel burnt at Kingston since it was commissioned is shown in Fig. 1. The addition of coke to the fuel increases ignition and grit emission problems. To ensure that the chain grate fuel bed ignites close to the point where it enters the furnace, it is necessary to employ hot gas recirculation and oil injection. Grit emission is controlled by electrostatic precipitators in series with mechanical grit arrestors. This causes the further problem of the disposal of these waste grits and fine ash.

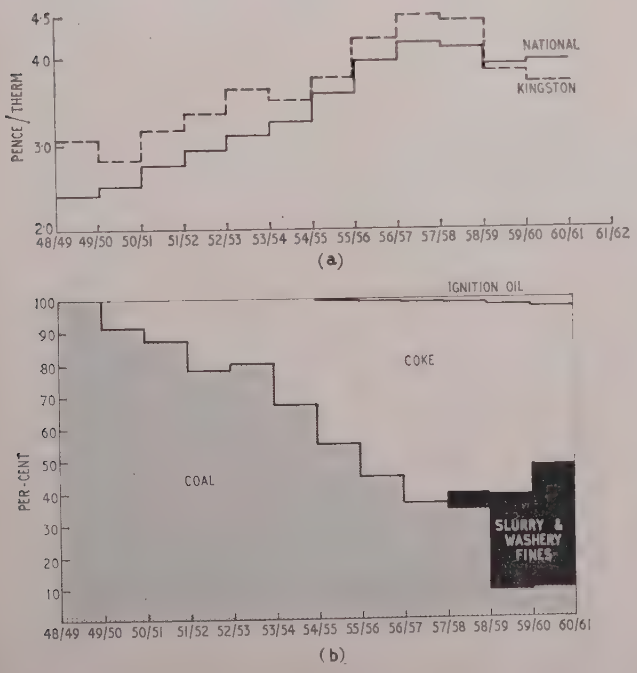

Fig. 1.—Delivered costs (a) and composition (b) of fuel at Kingston power station since it was commissioned in 1948

As the grit contains about 60 per cent combustible matter, it was decided to re-use it as fuel in the form of briquettes with low-grade coal and pitch as a binder. Experiments with a pilot mobile briquetting plant proved that at a cost of about 28s/ton, briquettes worth about 61s/ton would be made. Experience has now shown the Boards' investment of £80,000 was justified and will be amortised in full in five years, after which the equipment will continue to serve the station.

Apart from reducing fuel and grit disposal costs, the briquettes form saleable clinkers when burnt. A diagrammatic arrangement of the plant, which was supplied by W. C. Holmes & Co., Ltd., is shown in Fig. 2.

Welding in the Power Industry

THE Institute of Welding is organising its first large-scale exhibition at Buxton next year in connection with its spring meeting there. The theme of the meeting, which takes place from 30th April to 4th May, is welding for power generation. Nearly 30 papers, including several from other countries, have been specially written for this meeting. Welding Engineering 1962, as the exhibition has been named, will illustrate the rapid progress of welding technology in this country, especially in meeting the challenge of modern power generation plant construction.

Financial Section

STOCKS and SHARES

INVESTMENT activity had fallen away to a bare minimum during the painfully drawn-out period of suspense which preceded the announcement of the Government's new economic measures, so that the removal of the uncertainty was expected to release an accumulation of pent-up business into those Stock Exchange channels regarded as appropriate to the changed circumstances. From another direction, markets are looking for the volume to be raised as a result of the passing of the new Trustee Act, giving authority to the investment of trust funds in equities. Calculations are that this calls for decisions affecting several hundreds of millions of money restricted at present to gilt-edged securities.

G.E.C. Results

A preliminary statement on the General Electric Company's results for the year ended in March reflects the meagreness of the returns from heavy engineering and the unsatisfactory state of trade in radio, television and domestic equipment during the period. At £3¼ million (before tax) profits are down by almost one-third in comparison with 1959–60, and represent a return of less than 3 per cent on the group's total gross sales, which increased to £118½ million. After deduction of tax the net surplus falls short of the amount already distributed in the 10 per cent dividend (which did not apply to the shares issued in exchange for those of Radio & Allied Holdings). The statement adds that it will take time for benefits to accrue from the drastic measures introduced by the management early this year to strengthen the position. First market reactions to the announcements left the shares about 1s down, at 30s 3d, at which the yield is just over 6½ per cent.

Hoover's Earnings

Taking into account the restricted circumstances affecting trade in household goods during the first half of this year, expectations had of course been prepared for substantially lower figures in Hoover's interim statement. A sharp initial fall in the price of the 5s shares to 38s 6d—with the "A" shares at 36s 6d—suggested nevertheless that the announcement of the profit at a little under £2 million (before tax) was below estimates: it is less than half the profit made in the much more favourable corresponding period of 1960, and under one-third of the total for last year. Commenting on the figures, the company's statement said that turnover in the home market had been only marginally lower, and ascribed the setback to a combination of rising costs in general, special expenses associated with the introduction of new products, and intense competition overseas.

Hoover's interim dividend is being maintained at the previous rate of 5 per cent, but the six-month profits figures

Price Changes in

Company or Board	Nom. Value	Middle price 24th July	Week's Rise or Fall	Dividend Pre-vious	Dividend Last	Yield %	1961 High-est	1961 Low-est
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	73		3	3	4 2 2	75½	73
Brit. Elec. 1974/77	100	68½	+½	3	3	4 7 6	70½	68
Brit. Elec. 1976/79	100	70		3½	3½	5 0 0	73½	70
Brit. Elec. 1974/79	100	79½		4¼	4¼	5 7 0	82	79½
Brit. Elec. 1967/69	100	88½	+½	4½	4½	5 1 9	91½	88
Overseas Electric Supply								
Calcutta Elec.	£1	21/-	−1/-	7†	7½†	11 12 0	23/3	20/6
East African Power	£1	13/3	+3d	8	10	15 2 0	15/-	13/-
Nigerian Elec.	£1	18/-		8	10	11 2 0	19/9	15/6
Perak Hydro-Elec.	£1	22/6		10	10	8 18 0	23/6	17/6
Electrical Shares								
Aberdare Holdings	5/-	15/-		17½	17½	5 16 9	17/-	14/3
Aerialite	1/-	4/6		54	54	12 0 0	8/-	4/6
Allen, W. H.	£1	31/3	−9d	14	10*	6 8 0	42/6	31/3
Allied Insulators	5/-	8/3	−3d	20	10*	6 1 3	10/-	8/3
Alwyn Holdings	5/-	21/-x.c.	−1/3	12½	15‡*	3 11 6	22/3	16/6
Anglo-Portuguese Tel.	£1	20/9		9	9	8 13 6	25/-	18/9
Arcolectric	1/-	5/3	−9d	15	15	2 17 3	6/-	3/9
Aron Meters	£1	68/9		15	15	4 7 3	70/-	67/6
Assoc. Elec. Ind. Ord.	£1	38/3	+1/3	15	15	7 16 9	48/6	37/-
Automatic Tel. & El.	5/-	14/-	+6d	17	17	6 1 6	20/6	12/9
Babcock & Wilcox	£1	29/3	+1/-	9	9	6 3 0	36/6	28/3
Bakelite	10/-	47/-	−1/9	17½	17½*	3 14 6	60/-	42/-
Baldwin, H. J.	2/-	1/6	−3d	10	Nil	—	1/9	1/6
Berry's Electric	5/-	45/6	−6d	30	33⅓*	3 13 0	52/6	37/-
Bowthorpe Holdings	2/-	7/9		18½	22	5 13 6	10/3	7/9
Brit. Elec. Resistance	2/-	7/-		17½	17½*‡	5 0 0	8/9	6/6
Brit. Elec. Traction:								
Def. Ord. "A"	5/-	48/6		40	50	5 3 0	57/6	41/9
Brit. Electronic Ind.	5/-	10/6		—	15‡	7 2 9	15/3	10/6
B.I. Callender's	£1	57/3	+1/6	13½	13½	4 14 6	62/3	49/6
B.I. Callender's 6% Pref. ...	£1	16/6		6	6	7 5 6	18/3	16/6
British Thermostat	5/-	29/6	−2/6	20	27½	4 13 3	40/-	28/-
Brook Motors	10/-	54/-		25	25*	4 12 6	55/-	47/-
Bulgin, A. F.	1/-	11/-		55	40*	3 12 9	12/3	7/9
Bulpitts	5/-	17/9	−3d	15	16¼	4 11 6	27/6	16/9
Burco Dean	5/-	6/3	−9d	18	15	12 0 0	11/9	6/3
Cable & Wireless	5/-	17/3	+3d	10	10*‡	2 18 0	19/9	12/6
Cambridge Instruments ...	5/-	30/6	−1/6	12½†	22	3 12 3	38/6	30/-
Chloride El. Storage "A" ...	£1	81/3	+3/3	17½	20	4 18 6	91/-	72/-
Clarke Chapman	£1	41/3	−1/3	13¾	13¾	6 13 3	54/-	41/3
Clarke, T.	2/-	4/-		16	16	5 6 9*	5/3	3/6
Combined Elec. Mfrs.	4/-	7/3	+3d	—	12½	6 18 0	10/-	7/-
Contactor Switchgear	5/-	13/3	+6d	14	14	5 5 9	16/-	12/9
Cossor, A. C.	5/-	5/6	−3d	Nil	Nil	—	8/-	5/6
Crabtree	10/-	25/-		20	12½*	5 0 0	33/9	25/-
Crompton Parkinson	5/-	11/9	+3d	14	12½*	5 6 6	14/6	11/3
De La Rue	10/-	54/-		22½	22½*	4 3 3	70/-	54/-
Decca "A"	10/-	57/-	+2/-	20	23⅓	4 1 6	70/-	52/3
Desoutter	5/-	60/-		30	35	2 18 6	68/9	49/-
Dewhurst	2/-	9/9		20	20	4 2 0	13/-	7/6
Dictograph Tel.	2/-	11/-	−3d	20	20*	3 12 9	13/-	8/6
Dimplex	5/-	72/-	−4/3	—	30	1 14 9*	79/-	47/-
Dubilier Condenser	1/-	2/3		30	15*	6 13 3	3/-	2/3
Duport	5/-	11/3		17½	20	5 18 0*	17/-	11/3
E.M.I.	10/-	36/9		20	17½*	4 15 3	51/3	36/9
Eleco	2/-	8/-	−3d	20	20	2 10 0	10/6	4/3
Electrical Apparatus	5/-	18/9		14½	20	5 6 9	21/-	17/-
Electrical Components	5/-	8/-	−6d	15	11½*	7 3 9	9/9	8/-
Elec. Construction	£1	22/-		9	5	4 11 0	39/-	22/-
Elliott-Automation	5/-	32/6	+1/3	9·3	13	2 0 0	37/6	25/6
Enfield Rolling Mills	£1	40/-		15	15	7 10 0	51/6	40/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

created some surmise in the market about the chances of a final as good as last year's 40 per cent. It was calculated that on an annual basis they provided cover of only 1¼ times for a total payment of 45 per cent, and the company's comments on trading prospects in the remaining part of the year did not encourage hopes of substantially better results in the second half. In that respect, however, the introduction of the new models was regarded as an important factor, and assessments were in any case held over for review in the light of the Government's new measures.

Electrical Investments

Company or Board	Nom. Value	Middle price 24th July	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1961 Highest	1961 Lowest
Electrical Shares—continued						£ s d		
English Electric	£1	32/3	+1/9	10	10	6 4 0	40/9	30/3
English Electric 3¾% Pref. ...	£1	10/6		3¾	3¾	7 2 9	11/9	10/6
Ericsson	5/-	25/-	+1/-	13†	13†	4 5 0	32/-	22/3
Ever Ready	5/-	36/3		20	22½	3 2 0	40/-	31/6
Falk Stadelmann	£1	23/9		10	7½	6 6 3	26/-	21/9
G.E.C.	£1	30/3	−1/-	10	10	6 12 3	39/6	29/3
G.E.C. 6½% Pref.	£1	17/-		6½	6½	7 13 0	19/3	17/-
General Cables	5/-	5/3		15	Nil	—	6/3	5/9
G.H.P. Group	£1	23/6	−6d	6	7‡	5 19 3	24/6	17/-
Goblin (B.V.C.)	5/-	4/3	−6d	12½	10	11 15 3	8/6	4/3
Hackbridge Holdings	5/-	5/-		20	20	10 0 0*	6/9	5/-
Harland Engineering	5/-	14/-		16	16	5 14 3	19/-	14/-
Head Wrightson	5/-	25/6	+1/-	14	16	3 2 9	30/-	22/-
Heatrae	2/-	12/9		12½	25	3 18 6	19/-	12/6
Holophane	5/-	16/6		26	30	9 1 9	20/6	16/6
Hoover	5/-	38/6	−4/-	90	45*	5 17 0	55/6	37/6
Hunt, A. H.	4/-	20/-	−1/-	20	20	4 0 0	25/9	18/-
Intl. Combustion	5/-	26/9		30	30	5 12 3	33/9	24/-
Intl. Computers & T.	£1	90/-	−1/3	10	11¼	2 10 0	107/-	59/-
Johnson & Phillips	£1	22/-		Nil	5	4 11 0	24/-	17/6
Kenwood Mfg.	1/-	4/-		—	—	—	6/-	5/-
Laurence Scott	5/-	14/6	−3d	15	15	5 3 6	18/9	14/6
Lister, R. A.	£1	45/6	−9d	14	14	6 2 9	56/9	45/6
Lucas, J.	£1	54/-	+3d	12½	13¾	5 1 9	71/6	53/6
Marryat & Scott	2/-	17/6	−9d	27½	32½	3 14 3	18/6	13/9
Mather & Platt	£1	40/-		11	11	5 10 0	51/6	40/-
Metal Industries	£1	51/6	+1/6	14	15	5 16 6	66/6	50/-
Midland Elec. Mfg.	£1	64/-	−1/-	12	12	3 15 0	67/6	58/6
Murex	£1	41/3	−2/6	20	13*	6 6 3	51/6	39/3
Newman Ind.	2/-	7/-		12½	15	4 5 9	7/6	5/-
Oldham & Son	1/-	2/9		17½	17½*‡	6 7 3	3/-	2/3
Parsons, C. A.	£1	54/-	+1/-	9⅜	12½	4 12 6	72/6	46/9
Philips' Lamps	Fl.10	205/-	−15/-	16	16*	1 11 0	£13¼	£10¼
Plessey	10/-	52/-	−6d	16	17‡	3 5 6	60/-	46/6
Pullin Group	2/-	12/3		25	25	4 1 9	15/-	11/3
Pyrotenax	5/-	55/-	−1/3	40	45	4 1 9	65/-	46/6
Radiation	£1	28/-	−1/-	12	10	7 2 9	37/6	28/-
Reliance-Clifton	5/-	26/6		15	20	3 15 6	32/6	22/6
Reyrolle	£1	42/-	+1/6	17½	9¾*	4 12 9	51/6	36/6
Richardsons Westgarth	10/-	5/-		8⅓	Nil	—	8/3	5/-
Sangamo Weston	10/-	20/-	−6d	12½	13⅓	5 0 0*	25/9	19/9
Scott, James	5/-	30/-	−1/6	25	27½	4 11 9	32/-	25/6
Simon Engineering	5/-	35/-	−1/-	—	27½	3 18 6	43/9	28/-
Smith (England), S.	4/-	15/-	+3d	17½	20	5 6 9	23/9	14/6
Southern Areas	£1	19/6		5	6	6 3 0	23/-	14/6
Strand Elec.	5/-	17/9		14·6	20‡	5 12 9	20/-	12/3
Sturtevant	5/-	11/3	−3d	15†	13†	9 10 0	18/6	11/3
Sun Elec.	5/-	16/-	−3d	15	18½	5 15 0	17/6	16/-
T.C.C.	10/-	42/6		35	22½*	5 6 0	43/9	40/-
Telephone Rentals	5/-	23/9	−9d	15	15‡*	3 3 3	29/6	18/6
Thompson (John)	5/-	14/6		20	5	—	16/9	14/-
Thorn Elec.	5/-	47/6		20	25	2 12 9	63/-	44/6
Thornycroft	£1	24/3	+6d	6	6	—	34/9	23/9
Tube Investments...	£1	68/9		—	14	4 1 6	85/-	67/6
Ultra Electric	5/-	25/-	+1/-	20	25	—	31/3	12/6
Walsall Conduits	4/-	10/9		15	15	5 11 6	15/-	10/9
Ward & Goldstone	5/-	26/3	−9d	35	17½*	3 6 9	36/6	25/6
Watford	2/-	7/6		25	20*	5 6 9	10/9	7/6
Westinghouse	£1	34/6	−6d	11	11	6 7 6	45/-	34/6
West, Allen	5/-	10/9	+6d	12½	13½	6 5 6	14/6	10/3
Wilkins & Mitchell	5/-	9/-		17	21*	—	15/3	9/-
Wolf Electric	5/-	14/-	−6d	12½	13¾	4 18 3	17/6	14/-

Ward & Goldstone

In spite of the effect of restrictions upon demand from the motor-car, electrical appliances, radio and TV industries, Ward & Goldstone, whose annual meeting was held this week, succeeded in establishing new records for output and sales in the year ended in March. A further contraction of profit margins however kept trading profits to a level only just above the previous figures, and for the first time in many years the shareholders' return is not being increased, although the 17½ per cent distribution remains covered well over three times by surplus earnings. In his review the chairman showed that expansion of output capacity continued with vigour. He was reluctant to forecast the outcome of the current year's trading, but spoke very highly about the company's standards of efficiency.

Radio & TV Trust

More good progress was made in 1960–61 by Radio & Television Trust (formerly the Philco firm) towards consolidating the recovery of the company's fortunes from the difficulties which led to the writing-down of the 2s shares to their present denomination of 6d four years ago. In the twelve months ended last March there was a net profit of £138,000, against £74,000 for the previous nine months. The dividend is going up from the equivalent of 13⅓ to 20 per cent, covered as much as nine times over by the surplus available, and a 100 per cent scrip issue is to follow last year's 50 per cent distribution of the same kind. Present-day interests of the company are in the two subsidiaries Airmec, the makers of electronic equipment, and the British Communications Corporation, acquired in 1960 and engaged in radio-communication equipment.

Efco Issue

Efco have lately completed a "rights" issue to raise some £280,000, and the new 10s shares will continue to be transferable free of stamp duty until after mid-August. They have been quoted recently at about 30s 6d, to yield 3¾ per cent on the basis of the dividend, equivalent to the 11¼ per cent paid for 1960–61. In their statement with the issue the directors made no forecast of profits in the current year, but reported that the value of orders on hand was above last year's level and should compensate for the tendency for margins to narrow. They hoped, with the usual reservations, to maintain the same rate of dividend on the increased capital.

REPORTS and DIVIDENDS

The General Electric Co., Ltd., in a preliminary statement, reports that although the gross income from sales in the year ended 31st March last rose from £116,933,000 to £118,595,000 there was a reduction in the trading profit from £4,530,766 to £2,892,209. After adding investment income and deducting taxation the group net profit was £1,377,677, against £2,532,384 in 1959-60. The ordinary dividend is maintained at 10 per cent.

The unsatisfactory results are attributed first to the small profit margin on the "heavy" engineering side and secondly to the state of trade in the domestic appliance and radio and television business, which led to substantial losses. It is stated that the figures confirm the directors in the strong support which they gave to the drastic reorganisation decisions taken by the management earlier this year.

The directors also refer to the provision made against losses on the Hunterston (Scotland) nuclear power station contract; they consider that the £500,000 allotted for this purpose last year and other provisions already made are adequate.

Pirelli-General Cable Works, Ltd.—A dividend of 5 per cent is being paid for the year to 31st March on capital increased by a one-for-four scrip issue and a one-for-four rights offer. Last year 10 per cent was paid on the old capital. Profits increased from £416,635 to £446,298, but bank and other interest charges were substantially higher and the net profit came to £165,320 (£192,677).

Hoover's Lower Profit.—Announcing an unchanged interim dividend of 3d per 5s share, the directors of Hoover, Ltd., say that, as envisaged at the annual general meeting in April, the financial results for the first six months of the current year show a considerable reduction in profit when compared with the corresponding period of last year. Although overall turnover in the home market is only marginally lower, general costs have shown a marked increase, and this, together with the special costs associated with the introduction of new products, has brought about the lower profit figure. The intense competition in overseas markets, particularly in Europe, has also adversely affected profits.

The unaudited profits of the group for the first half-year, before taxation, amounted to £1,965,000 against £4,013,000 for January-June, 1960. After deducting £1,069,000 (£1,980,000) estimated taxation, and £37,000 (£73,000) proportion of profits of subsidiaries attributable to minority shareholdings, the net profit was £859,000 (£1,960,000).

The directors add: "With the general economic uncertainty prevailing there is little evidence of any improvement in trading conditions during the coming six months. In all directions we are intensifying our efforts to improve the overall efficiency of the company."

Davis & Timmins, Ltd.—The Delta Metal Co., Ltd., states that it has received acceptances in respect of 1,733,616 ordinary shares in Davis & Timmins, Ltd., in response to its offer. These shares, with those already owned within the Delta Group, represent 89·46 per cent of the issued ordinary share capital and the offer has been declared unconditional subject to permission to deal being granted for the new ordinary shares in Delta to be allotted in exchange.

Efco, Ltd., report a group net profit of £156,463 (against £152,890) after tax of £166,442 (£136,991). Dividends total the equivalent of $11\frac{1}{4}$ per cent on capital doubled by a scrip issue, against the equivalent of 10 per cent.

Cable & Wireless (Holding), Ltd., has declared an unchanged second interim dividend of $2\frac{1}{2}$ per cent for 1961 on capital increased to £$13\frac{1}{2}$ million by a one-for-five scrip and one-for-ten rights issues. The first interim of $2\frac{1}{2}$ per cent was paid on £10·4 million capital. A total of 10 per cent, as paid for 1960, has been forecast for this year. Group earnings, before tax, for the three months ended 30th June last, amounted to £420,000, against £385,930 in the corresponding period of 1960.

Murex, Ltd., report a group trading profit for the year to 30th April of £1,661,000, compared with £1,643,000 for the previous year. After depreciation and tax, the net profit is £691,000 against £707,000. The final dividend of 8 per cent makes a total of 13 per cent for the year, against an effective rate of $12\frac{6}{7}$ for the previous year, allowing for the three-for-four scrip issue. Turnover rose during the year by $12\frac{1}{2}$ per cent but the benefits were offset by reduced selling prices and increases in raw material costs.

Nalder Bros. & Thompson, Ltd.—Following the acquisition of all the Nalder Bros. & Thompson share capital by A. Reyrolle & Co., Ltd., it is announced that Mr. A. G. O'Neill, chairman, and Mr. E. W. Semmens, managing director, will continue in office and that the constitution of the board of directors remains unchanged except for the co-option of Mr. J. Bennett and Mr. W. Gray as directors.

Berry's Electric Magicoal, Ltd.—Commenting on the past year's results, the chairman (Mr. Raymond Berry) says that sales increased by 43 per cent and trading profit by 31 per cent. The total sales have more than trebled in three years; this has enabled the company to neutralise the effect of higher production costs and maintain competitive selling prices. The process of expanding factories, warehouses and plant continues and the new factory extension at Bletchley is nearing completion. They are an "export minded" company and absolute priority is given to this side of the business. They would welcome Britain's entry into the Common Market as a further challenge which they are confident they could meet successfully.

The current year has started well and they expect export sales to show an appreciable increase. In the absence of circumstances beyond their control, the prospects of further success could hardly be brighter.

Reliance-Clifton Cables & Industrial Products, Ltd.—In his annual review, Sir Robert Renwick (chairman) says that the abnormal demand experienced in the last months of 1960 did not continue into the present year but the general level of activity has remained satisfactory. Although the price war is over there is no improvement in prices and it is evident that the industry will not be returning to former conditions but is going to remain a highly competitive business. With the present meagre profit margins there will be difficult times ahead except for efficient producers sustained by a high level of demand.

Liquidation

Winding-up proceedings or liquidations are often undertaken for the purpose of reconstruction, the transfer of a business, or other reasons. The appearance of a company's name under this heading therefore does not necessarily indicate insolvency.

George Pill, Ltd., electrical engineers and radio and television dealers, 62, Cornwall Street, Plymouth.—Winding-up voluntarily. Liquidator, Mr. G. C. Ehlers, 28, Baldwin Street, Bristol, appointed by members and creditors on 4th July.

Bankruptcy

N. W. Doidge and **J. C. Stephenson,** formerly carrying on business in partnership as Doidge & Stephenson at 16, Coldwell Street, Felling, as electrical contractors.—Last day for receiving proofs for dividend 1st August. Trustee, Mr. W. Armstrong, Clarendon House, Clayton Street West, Newcastle-upon-Tyne.

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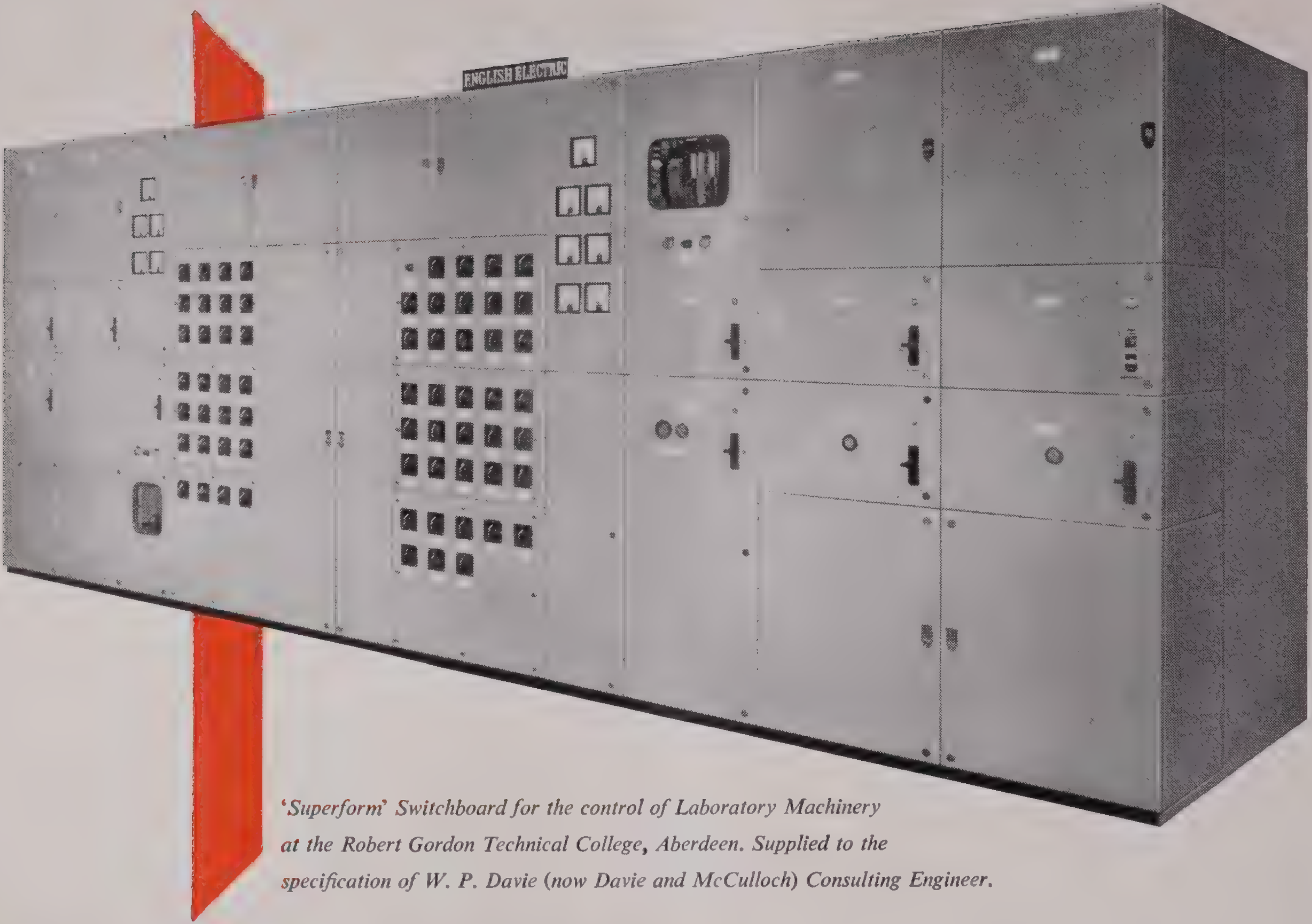

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English Electric 3,300 h.p. Type 5 diesel-electric locomotive in service

DELTIC LOCOMOTIVES IN SERVICE

A CONSIDERABLE acceleration of the train services from King's Cross to North-East England will be incorporated in the winter timetable which comes into force on 11th September. The journey time by certain trains to Yorkshire, Newcastle and Aberdeen will be reduced by periods between 43 and 59 minutes. This will have been made possible by the delivery to the Eastern Region of British Railways of 22 Type 5 diesel-electric locomotives. These are being manufactured by the English Electric Co., Ltd., and are based on the prototype "Deltic" locomotive which had completed over 400,000 miles in service with British Railways before it was withdrawn. Although basically similar, the production units incorporate a few modifications, including a reduction in weight to 99 tons, a lower generator speed of 1,125 r.p.m., and the use of bogies identical with those on the English Electric Type 3 locomotives. It is expected that they will replace 55 steam locomotives. Several are now in service, hauling trains to the existing schedules.

The principal data of the production locomotives are as follows:—Wheel arrangement, Co-Co; weight in working order, 99 tons; maximum axle load, 16½ tons; length over buffers, 69ft 6in; maximum tractive effort, 50,000 lb; and maximum service speed, 100 m.p.h.

The locomotive superstructure is arranged with a long central compartment, a driving cab at each end of this compartment and a nose end in front of each driving cab. The central compartment accommodates the two power units, the automatic train heating steam generator and the storage battery. Control cubicles at each end of the compartment form the rear bulkheads for the driver's cabs. The nose compartments accommodate the air compressor and vacuum exhausters in opposite ends together with the traction motor blowers. The removable roof sections over the power units house the fans, coolant and lubricating oil radiators together with the associated pipework, thermostats and header tanks for each engine.

The bogies are identical with those of the English Electric Type 3 locomotives and are completely interchangeable with them. They are of the equalised type with swing bolsters and have three motorised axles. The bolsters are fabricated in a box section and cooling air for two of the traction motors passes through each hollow bogie centre via the bolster through flexible connections to the motors. Air passes through ducting and similar flexible connections direct to the third motor.

Power Units

The two power units are identical, each consisting of a Napier Deltic Type D18-25 diesel engine direct coupled to an English Electric main generator with an auxiliary generator driven from the engine phasing gearbox. The main generator is a direct current, self-ventilated machine with a continuous rating of 1,650 A at 660 V, the armature being directly coupled to the engine output shaft on which the engine crankshaft speed of 1,500 r.p.m. is stepped down to 1,125 r.p.m. This coupling also forms the hub of the generator ventilating fan with the opposite end of the armature shaft supported in a single self-aligning roller bearing. In normal service the two main generators are connected in series and supply the six traction motors but the locomotive can operate with either power unit running and develops full tractive effort, although at half voltage and consequent lower road speed.

Each main generator has an auxiliary generator mounted above it, driven by a take-off shaft from the engine phasing gearbox at 1⅗ times the engine crankshaft speed. This auxiliary generator supplies current at 110 V for field excitation of the main generator, control and auxiliary circuits, the load being shared by both generators when both diesel engines are running. If the locomotive is working on one engine only, however, the full auxiliary load can be taken by the one auxiliary generator.

The 18-cylinder diesel engine operates on the two-stroke opposed piston principle and has a rating of 1,650 h.p. at 1,500 r.p.m. The cylinders are arranged in three banks of six in the form of an equilateral triangle so that in effect the engine consists of three opposed piston engines combined together with common crankshafts at each corner. Power is transmitted to the driving wheels by six axle-hung nose-suspended traction motors, one being mounted on each axle which it drives through single-reduction gears. These motors are four-pole series wound d.c. machines and are electrically connected in three parallel groups of two motors in series. Two stages of field weakening are provided to extend the locomotive speed range over which full power is available.

In normal service both power units are in operation and power is controlled from a master controller at either driving position. The engines are controlled simultaneously by air pressure actuators operating the spring loading of the engine governors to raise or lower the engine speed. A load regulator for each power unit varies the excitation of each main generator by adjusting resistance in the generator field circuit through electrical contacts. These contacts are operated by an oil servo motor controlled by a valve in the engine governor which is sensitive to engine loading. The generator field excitation is therefore regulated to match the electrical traction loading to the available engine horsepower at all engine speeds.

Protective devices include automatic correction of wheel slip and automatic shutdown of the engines on high cooling water temperature, low cooling water level and low lubricating oil pressure. Indication of these circumstances is given to the driver by warning light, as is boiler shutdown, traction motor blower failure and low fuel level.

AGRICULTURAL SHOWS

THE influence of electricity on present-day farming received ample recognition at the Kent County Agricultural Show where the South Eastern Electricity Board, as in previous years, had a fine display of electrical agricultural machinery and appliances, horticultural equipment and domestic electrical appliances. The Show, held at Mote Park, Maidstone, recently, was as popular as ever and despite the cool showery weather the number of inquiries received at the Seeboard stand was well up to expectations. This year the Board had a completely redesigned stand and the display area, although slightly smaller, was as informative as on previous occasions. In the agricultural section, instead of displaying such large items of equipment as milling and mixing machines, grain dryers, etc., a pictorial form of presentation was used, the emphasis being on local applications. Other pictures told the story of the off-peak use of electricity for floor warming for chicken brooding and all-the-year-round growing of chrysanthemums by controlled lighting.

Electric tools for the garden or smallholding are becoming more and more commonplace. In the comprehensive display of hedge trimmers, cultivators, pruning saws, drills, etc., all models shown were designed for use on low voltage only. It is understood that Seeboard feels strongly on this subject and it is now the Board's policy to stock and recommend the use only of low voltage appliances of this nature, including electric lawn mowers.

Of special interest in the poultry section was a unit for lighting and ventilation control in broiler and intensive laying houses. The apparatus, manufactured by Electronic Poultry Aids, Ltd., makes use of Fenton Byrn fans and twenty different ventilating selections can be obtained. In the automatic position the fans are controlled by a master temperature control unit, part of which consists of a 24in rod type thermostat. Vent-Axia, Ltd., also had on show a range of automatic shutter type air conditioners, including their recently introduced model.

Domestic appliances were well to the fore in the cookery section and many of the leading makes of laundry equipment, dishwashers, food mixers and cookers were demonstrated.

Great Yorkshire Show

In spite of torrential rain on the second day of the three-day Great Yorkshire Show the attendance was well up to expectations and the "Electricity" stand, organised jointly by the Yorkshire and the North Eastern Electricity Boards, was thronged each day by visitors.

The Boards showed a complete milling, mixing and cubing plant which was in almost continuous operation and, in addition, a Templewood automatic mix-mill unit was demonstrated at frequent intervals. Crop conservation was another prominent feature, showing three methods of grain-drying, namely, floor-ventilated silos, radially-ventilated silos with automatic humidity control and the platform method. Grain handling equipment was included. A separate section for barn hay-drying showed the storage method and the tunnel method of bale-drying.

The poultry section was designed to attract the broiler producer. A large cut-away model of a warm-floor brooder was shown, backed up by photographs showing various stages of actual installations in broiler houses. For ventilation and lighting in broiler houses the Boards showed an automatic controller in operation and a separate ventilating fan controlled by a thermostat which also gave intermittent operation irrespective of temperature.

For horticulturists, a large greenhouse was fitted with mist propagation plus soil-warming, an automatic watering equipment and an "Activair" heating and ventilating unit. In the domestic section cooking, home laundry, space heating, water heating and refrigeration exhibits were shown.

Industrial Activity in Ulster

SUPPLIES to two large industrial consumers were responsible for nearly half of the expansion of 25 per cent in sales by the Electricity Board for Northern Ireland in the year ended 31st December, 1960. Excluding these consumers—Carbide Industries, Ltd., and the Du Pont Co. (United Kingdom), Ltd.—the remainder of the system load growth represented a 13 per cent increase compared with 9 per cent in the previous year. Sales for all purposes totalled 768 million kWh.

Having regard to the relatively lower cost of oil used for generation at the new Coolkeeragh power station, the maximum possible load was allocated to that station, resulting in a considerable reduction in the weighted average cost of fuel consumed in the interconnected stations. The Board decided to make a further concession which will result in an overall reduction in charges to consumers of about £50,000 in a full year, in addition to some £330,000 passed on to consumers during 1960, but since then the Budget increase in oil duty has added substantially to its fuel bill.

The aggregate number of consumers of all classes at the end of the year was 178,867 (88,735 rural and 90,132 urban). Gross revenue amounted to £5,997,424 (against £5,350,225). After meeting all charges and transferring £25,000 to general reserve, there was a net surplus of £12,221 to which is added £29,783 brought forward.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

1946

18326. Wigner, E. P., and Young, G. J.—Reactors. 18th June, 1946. (873365.)

1956

33394. A.E.I.-John Thompson Nuclear Energy Co., Ltd.—Nuclear reactors. 14th August, 1957. (873612.)

33420. Microcell, Ltd., and Kremer, H.—Electric cables. 31st January, 1958. (873834.)

34936. Electric & Musical Industries, Ltd.—Colour television apparatus. 15th November, 1957. (873550.)

34959. Electric & Musical Industries, Ltd.—Dividing circuits. 15th November, 1957. (873509.)

35607. Associated Electrical Industries, Ltd.—Automatic electrical control circuits. 6th January, 1958. (873835.)

36517. Caire, P.—Variable frequency asynchronous generator system. 9th May, 1960. (873026.)

38753. Associated Electrical Industries, Ltd.—D.c. excitation control arrangements for dynamic braking of electric motors. 13th March, 1958. (873366.)

38946. English Electric Co., Ltd.—Electrical time overcurrent protective relays. 16th December, 1957. (873129.)

1957

2810. General Electric Co., Ltd.—Rotors for dynamo-electric machines. 14th January, 1958. (873836.)

3488. Associated Electrical Industries, Ltd.—Alloys containing rhenium. 31st January, 1958. (873837.)

3498. Electric & Musical Industries, Ltd.—Cavity resonator magnetrons. 21st November, 1957. (873510.)

17350. International Computers & Tabulators, Ltd.—Information storage devices. 22nd April, 1958. (873367.)

18126. Simplex Electric Co., Ltd.—Electric cooking stoves. 5th June, 1958. (873839.)

24166. Bose, A. G.—Transducers. 30th July, 1957. (873511.)

24911/2. Simplex Wire & Cable Co.—Apparatus for the manufacture of insulated conductors. 7th August, 1957. (873840/1.)

27118. A.E.I.-John Thompson Nuclear Energy Co., Ltd.—Nuclear reactors. 21st October, 1958. (873369.)

27629. United Kingdom Atomic Energy Authority.—Mixer-settler apparatus. 21st July, 1958. (873599.)

28018. United Kingdom Atomic Energy Authority.—Fuel elements for nuclear reactors. 21st July, 1958. (873370.)

28431. Gutwein, E. D.—Electric selector switches. 8th September, 1958. (873754.)

32754. C. A. Parsons & Co., Ltd.—Fuel elements for nuclear reactors. 13th October, 1958. (Cognate application 1234, 13th January, 1958.) (873552.)

33999. Bush & Rank Cintel, Ltd.—Circuit arrangements for generating cyclically varying currents in inductive loads. 31st October, 1958. (873828.)

34361. A. C. Nielsen Co., Ltd.—Apparatus for monitoring the use of radio receivers. 4th November, 1957. (873626.)

35068. Rondot, Y. B., and Rondot, F. A.—Towers for supporting overhead electric conductors. 11th November, 1957. (873354.)

35077. Engelhard Industries, Inc.—Automatic cathodic protection system. 11th November, 1957. (873845.)

35496. Philco Corporation.—Manufacture of semiconductive devices. 14th November, 1957. (873484.)

35660. Kato, M.—Electric motor suitable for use in toys. 15th November, 1957. (873829.)

35989. Johnson & Phillips, Ltd., and Ashby, R. J.—Transportation of submarine cables from the shore to the cable ship. 19th November, 1958. (873430.)

37385. Howard Butler, Ltd.—Housings for electrical measuring or indicating instruments. 4th November, 1958. (873755.)

37657 Associated Electrical Industries, Ltd.—Transistors. 3rd December, 1957. (873485.)

39716. English Electric Co., Ltd.—Apparatus for the control of grid-controlled electric discharge devices. 20th December, 1957. (Addition to 774400.) (873436.)

1958

238. Neff Instrument Corporation.—Electrical signal amplifiers. 2nd January, 1958. (873631.)

465. Philips Electrical Industries, Ltd.—Methods of manufacturing semiconductive bodies. 6th January, 1958. (873490.)

2647. Philips Electrical Industries, Ltd.—Synchronised crystal oscillators. 27th January, 1958. (Addition to 710988.) (873493.)

5508. Standard Telephones & Cables, Ltd.—Electrical rectifying equipment. 20th February, 1958. (873497.)

9350. Pressac, Ltd.—Multi-pin or multi-socket electrical connectors. 26th May, 1959. (873372.)

12724. Igranic Electric Co., Ltd.—Electromagnetic devices. 22nd April, 1958. (873373.)

12811. English Electric Co., Ltd.—Electrically propelled vehicles. 14th April, 1959. (873374.)

15101. Plessey Co., Ltd.—Circuit arrangements for protecting circuit elements in electronic circuits. 12th May, 1959. (873758.)

16151. General Electric Co.—Stator casing assembly for use in gas compressors or turbines. 20th May, 1958. (873759.)

16710. A. Reyrolle & Co., Ltd.—Oil-immersed fuses. 22nd May, 1959. (873440.)

18822. Electric Transmission, Ltd.—Electric insulators. 8th June, 1959. (873356.)

18890. General Electric Co., Ltd.—Electrical apparatus for giving a visual presentation of figures, letters and/or other symbols. 12th June, 1959. (Addition to 833046.) (873773.)

20774. United Kingdom Atomic Energy Authority.—Temperature control means for nuclear reactors. 9th June, 1959. (873074.)

21549. Associated Electrical Industries, Ltd.—Potential testing circuits. 15th June, 1959. (873523.)

35372. Philips Electrical Industries, Ltd.—Circuit arrangements for supplying a load with a controlled output voltage from a rectifier. 4th November, 1958. (873052.)

1959

19516. Marconi's Wireless Telegraph Co., Ltd.—Electrically heated thermostatically controllable containers. 16th December, 1959. (Addition to 802333.) (873122.)

29043. Western Electric Co., Inc.—Oscillation generators for multi-frequency signalling systems. 25th August, 1959. (873189.)

29312. English Electric Valve Co., Ltd.—Television camera tubes. 11th February, 1960. (873041.)

30774. Brookhirst Igranic, Ltd.—Energising control systems for electromagnets. 9th September, 1959. (873042.)

34802. Siemens & Halske A.G.—Methods of manufacturing semiconductor components. 14th October, 1959. (873043.)

38887. Eaton Manufacturing Co.—Electromagnetic couplings. 17th November, 1959. (873163.)

1960

4383. Philco Corporation.—Manufacture of semiconductor devices. 8th February, 1960. (872966.)

14940. Philips Electrical Industries, Ltd.—High frequency ovens. 28th April, 1960. (873082.)

16770. Compagnie Générale de Télégraphie sans Fil.—Ladder type delay lines. 12th May, 1960. (873335.)

22200. Licentia Patent-Verwaltungs-G.m.b.H.—Self-starting single-phase miniature synchronous motor. 6th January, 1958. (Divided out of 872429.) (872430.)

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 19th August.

Alitape. No. B815,581. Class 6. Strips and tapes, all made of common metal.—D.K.B. Electric, Ltd., 62/63, Queen Street, London, E.C.4.

CirCarc. No. 815,075. Class 7. Gears and gearing (not for land vehicles).—Associated Electrical Industries, Ltd., 33, Grosvenor Place, London, S.W.1.

Bambi. No. 805,309. Class 9. Electrical connectors.—Hellermann, Ltd., Crawley, Sussex.

Physikit. No. B809,809. Class 9. Kits of component parts (sold complete) for the manufacture of electric discharge tubes (not for lighting purposes).—J. H. Owen Harries, trading as Owen Harries, Warwick, Bermuda. Address for service: Gill Jennings & Every, 51-52, Chancery Lane, London, W.C.2.

Roydazide. No. 817,576. Class 9. Scientific and electrical apparatus. No. 817,577. Class 11. Installations for lighting and heating.—Doulton & Co., Ltd., Doulton House, Albert Embankment, London.

Stemmatron. No. 817,524. Class 9. Electronic tubes (not for lighting purposes).—Compagnie Française Thomson-Houston, Paris. Address for service: Baron & Warren, 16, Kensington Square, London, W.8.

Konamik and **Elekon.** Nos. 817,989/90. Class 9. Coupling and junction boxes for electric cables.—Kay & Co. (Engineers), Ltd., Bolton Brass Works, Blackhorse Street, Bolton, Lancs.

Proscontroller. No. B818,125. Class 9. Instruments for automatically controlling temperature.—Process Control Gear, Ltd., 44, Lattimore Road, St. Albans, Herts.

Resistron. No. 818,126. Class 9. Measuring, signalling, checking and counting apparatus; electrically operated apparatus for indicating the level of liquids, granules and like materials; apparatus for automatically controlling the operation of industrial machinery and for giving audible or visual warning of failures, etc.—Thomas Industrial Automation, Ltd., 71-73, Station Buildings, Altrincham, Ches.

Copelametic. No. 814,494. Class 11. All goods included in Class 11.—Copeland Refrigeration Corporation, U.S.A. Address for service: J. A. Kemp & Co., 14, South Square, Gray's Inn, London, W.C.1.

Pye. No. 819,342. Class 11. Nuclear reactors and parts.—Pye, Ltd., Radio Works, St. Andrews Road, Cambridge.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Australia.—Water, Sewage and Drainage Board, Sydney. 22nd August. Electrically driven disintegrator units. (E.S.B. 23306/61.)* Pumping unit. (E.S.B. 23305/61.)*

Electricity Commission of Victoria. 14th August. 230 kV switchgear and accessories. (E.S.B. 23472/61.)*

Postmaster General's Department, Melbourne. Telephone cable. (E.S.B. 23494/61.)*

N.S.W. Electricity Commission. 18th September. Two 60 MVA transformers for White Bay power station. (E.S.B. 23462/61.)* 25th September. 310 MVA generator transformer for Vales Point power station. (E.S.B. 23016/61.)*

Southern Electric Authority of Queensland. 24th November. 30 MW turbo-alternator for Bulimba "B" power station. (E.S.B. 22020/61.)*

Breconshire.—County Council. 8th August. Electrical installation in comprehensive mixed school, Brynmawr. (See Classified Advertisement Section.)

Egypt.—Technical Bureau of U.A.R. Electrification Projects. 25th October. 220 kV overhead transmission lines, transformer stations, etc. (E.S.B. 23429/61.)*

Formosa.—Central Trust of China. 17th August. Electrical power equipment, industrial vacuum cleaner and air conditioner. (E.S.B. 23704/61.)* Telephone exchange equipment. (E.S.B. 23705/61.)*

Shihmen Development Commission, 25th August. Switchgear. (E.S.B. 23098/61/D.L.F.)*

Germany.—N.A.T.O. Infrastructure Contract. Underground cable, lights and floodlights for runway extension lighting system. Applications to tender by 2nd August. (G.D. 2308/61(167).)†

Greece.—Ministry of Trade. 8th August. Automatic electric welding apparatus. (E.S.B. 23448/61.)*

Hellenic Telecommunications Organisation, Ltd., Athens. 11th August. Fifteen 3 kVA diesel generator sets. (E.S.B. 23488/61.)*

Hornsey.—Borough Council. 9th August. Sodium lighting in Archway Road, Great North Road and Hornsey Lane. (See Classified Advertisement Section.)

India.—India Store Department. 30 MVA synchronous condenser, starting switchgear and control panels for Bangalore switching station. (See Classified Advertisement Section.)

National Coal Development Corporation, Ltd., Ranchi. 16th August. Three 11 kV, 200 A, 250 MVA circuit-breakers. (E.S.B. 23764/61.)*

Korea.—Government Office of Supply. 9th August. Railway electrical equipment. (E.S.B. 23071/61.)*

Nigeria.—Electricity Corporation of Nigeria. 24th August. Supply and commissioning of two small electricity undertakings in connection with the Corporation's development schemes. (See Classified Advertisement Section.)

Norway.—N.A.T.O. Infrastructure Contract. Four broadcasting stations. Applications to tender must be received by 10th August. (G.D. 159/60(29).)†

Pakistan.—West Pakistan Water and Power Development Authority. 22nd August. Ten 66 kV substations in Multan, Montgomery, Jhang and Lyallpur areas. (E.S.B. 23428/61/D.L.F.)*

Portugal.—Douro and Leixoes Port Administration. 4th September. Eighteen 5-ton electric quay cranes. (E.S.B. 23480/61.)*

Portuguese East Africa.—Ports, Railways and Transport Department, Lourenço Marques. 25th August. Electrical equipment. (E.S.B. 23435/61.)*

Rhodesia and Nyasaland.—Ministry of Health. 11th August. Electric washing machine/spin dryers and ironers. (E.S.B. 23478/61.)*

Singapore.—City Council Electricity Department. 15th August. Transformers. (E.S.B. 23785/61.)*

Sudan.—Railways Stores Department, Atbara. 24th August. Switchboards. (E.S.B. 24017/61.)*

Tasmania.—Hydro-Electric Commission. 14th August. 205 distribution transformers. (E.S.B. 23461/61.)*

Thailand.—State Railways. 28th August. Turntable electric drive. (E.S.B. 23432/61.)*

Trinidad.—Electricity Commission. 12th September. Metering equipment. (E.S.B. 23491/61.)*

United States.—Bonneville Power Administration. 8th August. 2,200 bus and switch insulators. (E.S.B. 23753/61.)*

ORDERS PLACED

Newcastle-upon-Tyne.—Regional Hospital Board. Installation of lifts at West Cumberland Hospital (£70,423).—William Wadsworth & Son. Electrical installation in pathological laboratory, Darlington Memorial Hospital (£3,859).—Doves. Electrical work for proposed nursery accommodation at Richard Murray Maternity Hospital (£1,100).—A. S. Lowrey & Son.

Stockton-on-Tees.—Corporation. Electrical installation in new Hardwick Secondary Modern School (£10,177).—Cox-Walkers.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Andover.—Three-storey flats (16), London Road housing site; borough surveyor, Municipal Buildings.

Ashford (Kent).—Houses (113), Brookfield North, Beaver Green; surveyor, 1, Elwick Road, Ashford, Kent.

Barrow.—Development of private housing estate between Mill Lane and Sileby Road; Jelson (Estates), Ltd., Shenton Street, Leicester.

Basingstoke.—Maisonnettes (80), South Ham; borough architect, Municipal Buildings.

Bath.—Five blocks of maisonnettes and flats on the Twerton/Whiteway estate; planning officer, 7, North Parade Buildings.

Billingham-on-Tees.—Ten-storey blocks of flats; Elder & Lester, architects, Town Square, Queensway.

Birmingham.—Training centre for senior girls, Bristol Road (£117,600); A. G. Sheppard Fidler, city architect.

Blaydon (Co. Durham).—Offices, Chainbridge Road, for Valley Plastic Coaters, Ltd.; Wetherell, Lamb & Partners, architects, 24, Picton Place, Newcastle-on-Tyne.

Bootle.—Houses (36), Litherland Road; borough surveyor, Town Hall.

Bournemouth.—Demolition of Grand Hotel and erection of motor showroom, supermarket, shops, offices, etc.; Imperial & Grand Hotels, Ltd., Fir Vale Road, Bournemouth.

Bristol.—Office block, Baldwin Street, for McKay Securities, Ltd.; Alec F. French & Partners, architects, Pearl Assurance House.

Darwen.—Modernisation scheme, Britannia Mill (£200,000); Imperial Chemical Industries, Ltd.

Dublin.—Factory and offices for Precision Alloys, Ltd.; Robinson, Keefe & Devane, architects, 22, Lower Baggot Street.

Dunstable.—New courthouse (£50,000); county architect, Shire Hall, Bedford.

Edinburgh.—Napier Technical College, Merchiston Castle site; Alison, Hutchison & Partners, architects, 4, Rothesay Terrace.

Fleet.—Office block, Odeon Theatre site; Raymond J. Husband, architect, 126, Wigmore Street, London, W.1.

Glasgow.—New Allan Glen Senior Secondary School (£500,000); architect, Education Department, Bath Street, C.2.

Hanley.—Police headquarters (£230,000); city architect, Kingsway, Stoke-on-Trent.

Harrow.—Central clinic, Headstone Drive (£52,385); county architect, 1, Queen Anne's Gate Buildings, London, S.W.1.

Havant.—Fire station; Jackson & Greenen, architects, Hinton Buildings, Bournemouth.

Leamington Spa. — Factory, Althorpe Street; Sotowear, Ltd., 1, Bedford Street.

London.—Seven-storey block of flats, Hill Street, Mayfair; Leslie & Co., Ltd., Peel Street, W.8.

Factory, North Circular Road, Hendon; Jabez Barker & Co., Ltd., Brent Street, N.W.4.

Office block, Caxton Street, Westminster; Kyle Stewart, Ltd., Ardshiel House, Wembley.

Rebuilding Albion County Primary School, Bermondsey (£86,070); E. Lyons, architect, Mill House, Bridge Road, East Molesey, Surrey.

Porth.—Factory extension; Royal Worcester Industrial Ceramics, Ltd., Gilfach Road, Tonyrefail.

St. Neots.—First stage of factory extension scheme in Priory Lane; R.F. Development, Ltd., St. Neots, Hunts.

Sunderland.—Proposed Thornhill Comprehensive School; H. C. Bishop, borough architect, Stockton Road.

Swindon.—Erection of courts of justice, central redevelopment area; borough engineer, Civic Offices.

Tipton.—Dwellings (72), Grovelands Road; borough engineer.

Tonbridge.—Extension, Tonbridge School (£150,000); Sir Wm. Holford & Partners, architects, 2a, Angel Court, London, E.C.2.

Twickenham.—Six-storey offices on Savoy Cinema site, Teddington; secretary, Automobile Association, Fanum House, Leicester Square, London, W.C.2.

Tynemouth.—Houses (142); borough engineer, 16, Northumberland Square, North Shields.

Wallasey.—Factory extension; Cadbury Bros., Ltd., Pasture Road, Moreton.

West Hartlepool.—Proposed Church of the Latter-Day Saints (£100,000); G. T. Brown & Son, architects, 14, Grange Terrace, Stockton Road, Sunderland.

Windsor. — Reconstruction of County Grammar School for Girls, Imperial Road (£263,286); county architect, Parkside Road, Reading.

York.—Works extensions; Bootham Engineers, Ltd., Bootham Row.

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* This information is extracted from the Board of Trade *Export Service Bulletin*. Inquiries should be addressed to the Board of Trade, Export Services Branch, Lacon House, Theobald's Road, London, W.C.2 (Telephone: Chancery 4411, Ext. 738), quoting the reference given. †Telephone: Trafalgar 8855, Ext. 2010.

MAIN CONTRACTORS: A.E.I. Ltd.
CONSULTING ENGINEERS: Merz & McLellan

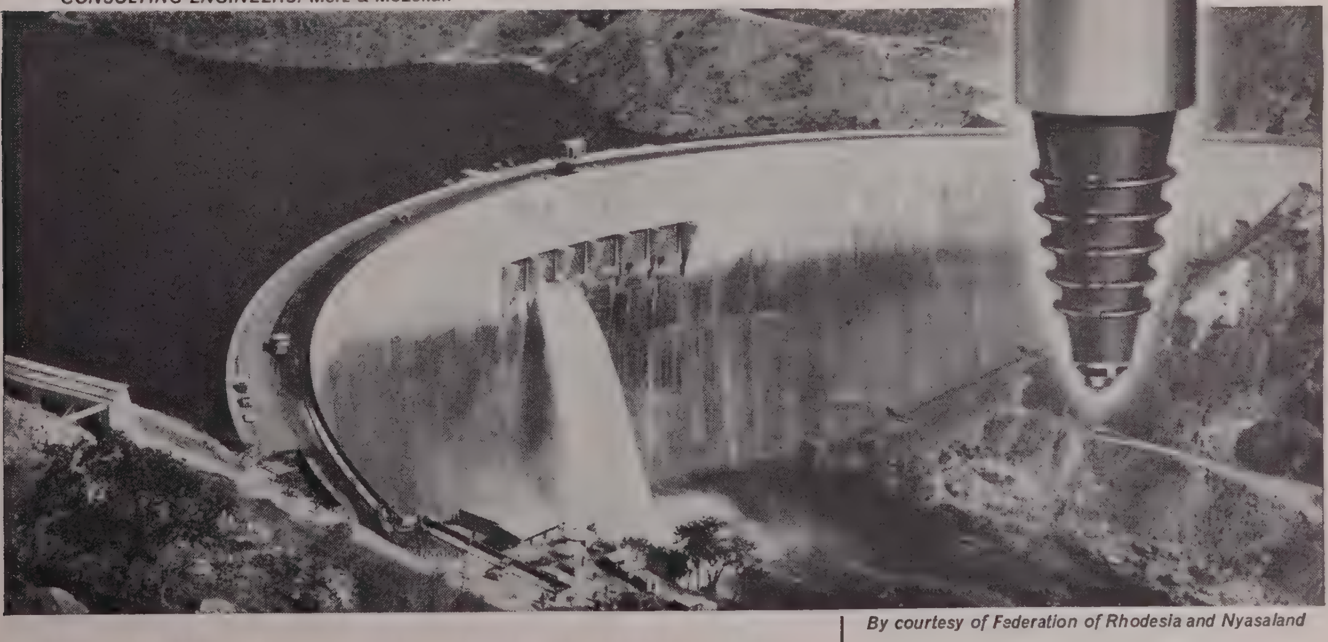
insulating KARIBA'S giant power 330 kV

All the bushing porcelains for the 330 kV. circuit breakers, all the 330 k.V. strain insulators for the substations, and the 330 kV. post insulators for some of the substations were supplied by

BULLERS

Units of the switch gear on the south bank. Power for the Copperbelt and for Southern Rhodesia passes through this stage.

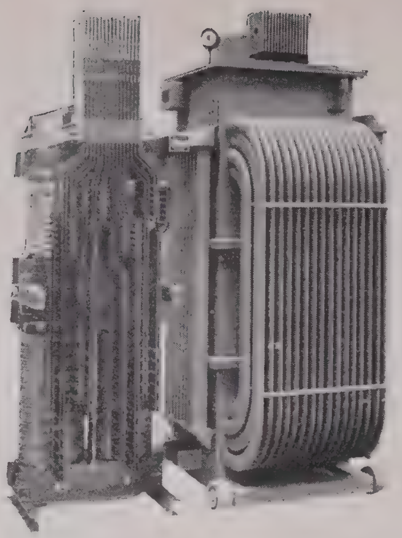
A complete 330 kV. bushing insulator (by courtesy of A.E.I. Ltd.)



By courtesy of Federation of Rhodesia and Nyasaland

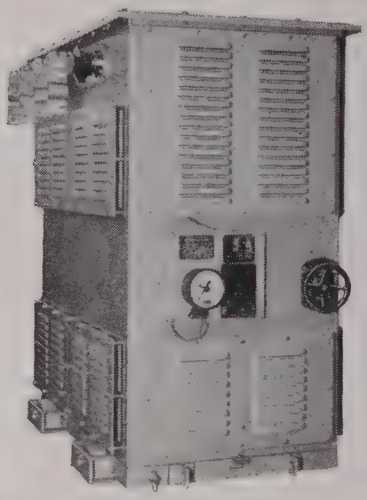
BULLERS LIMITED · MILTON · STOKE-ON-TRENT · STAFFS
Telephone: Stoke-on-Trent 54321

LONDON:- 6 Laurence Pountney Hill · E.C.4
Telephone: MANsion House 9971

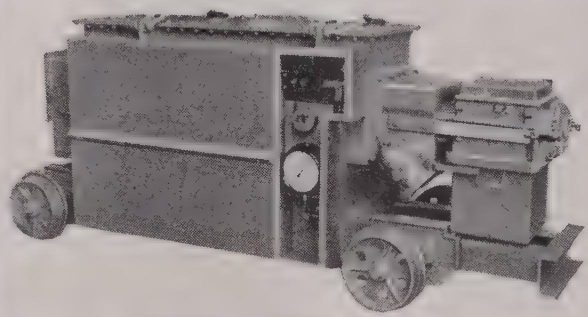


Furnace Transformer supplying 15000 amperes for continuous tube welding.

Dry Type Class 'C' Transformer in range up to 3000 kVA at 15 kV or in Nitrogen up to 2000 kVA at 15 kV.



SPECIAL TRANSFORMERS FOR SPECIAL APPLICATIONS



Class 'C' Nitrogen cooled mining transformer with low head room.

Bank of Rectifier Transformers.

BRENTFORD B

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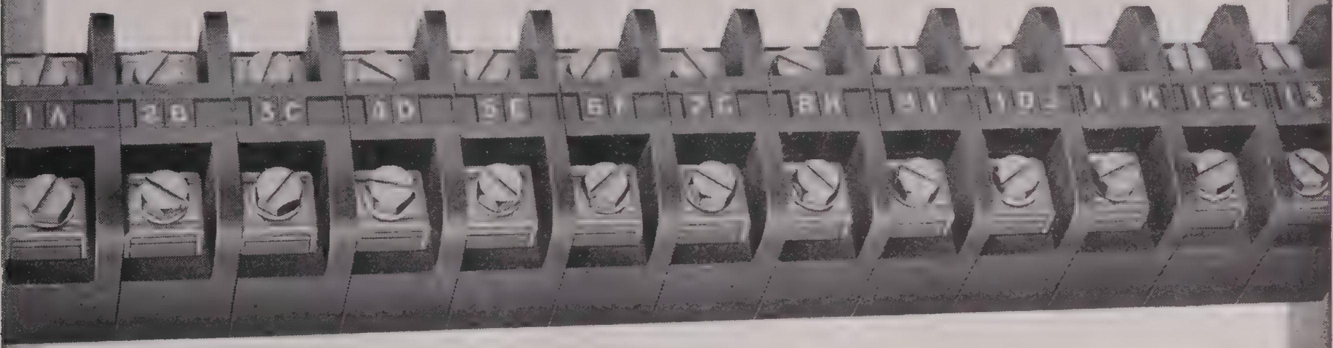

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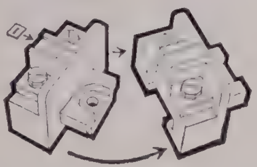

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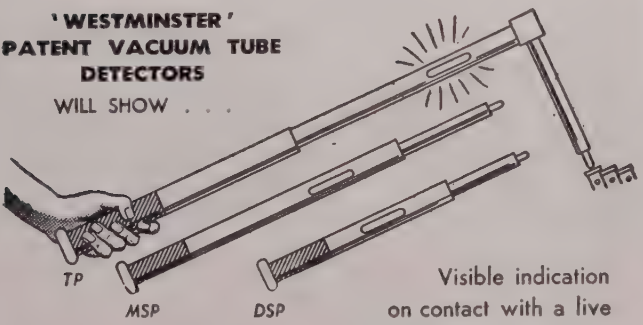

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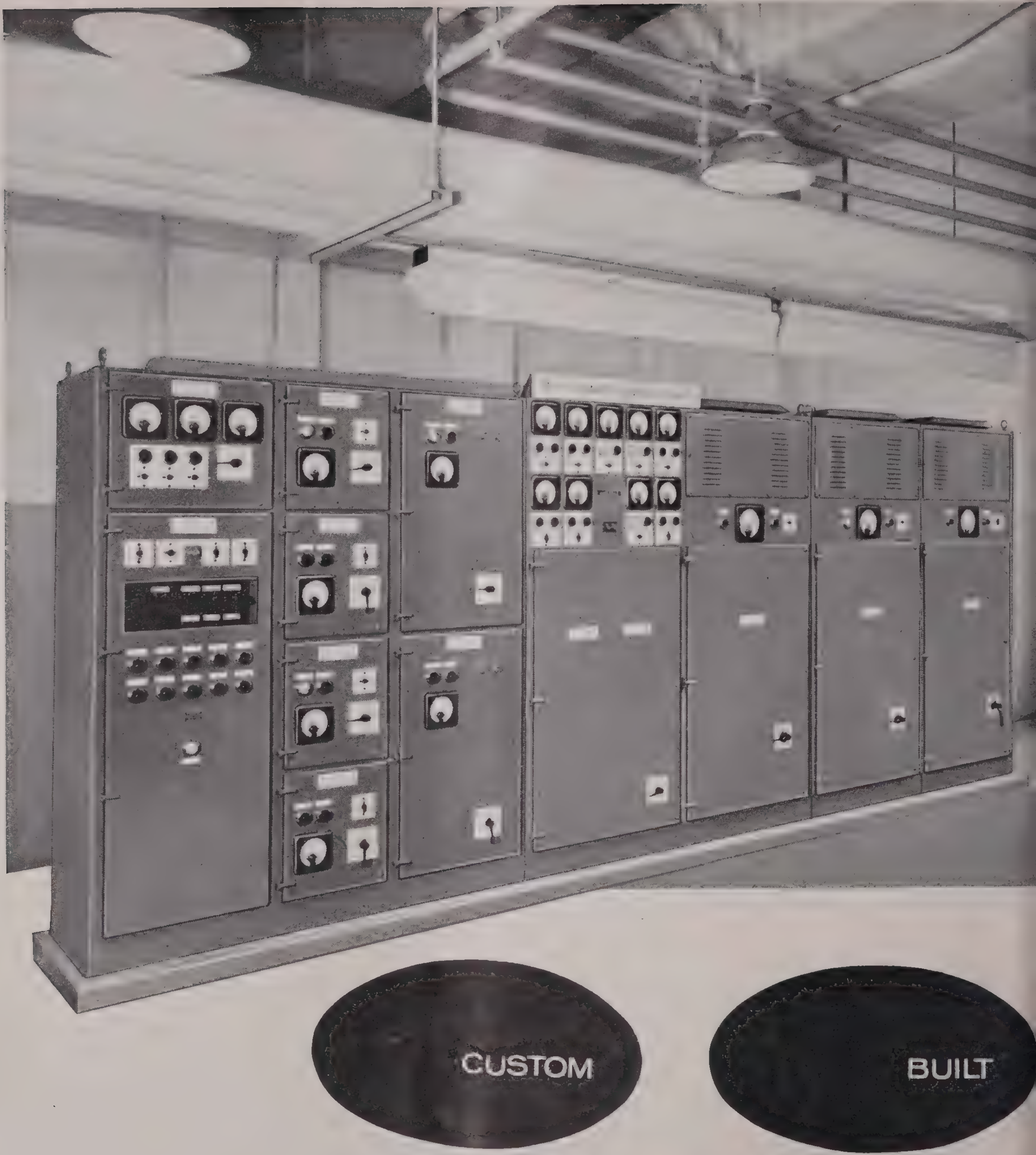

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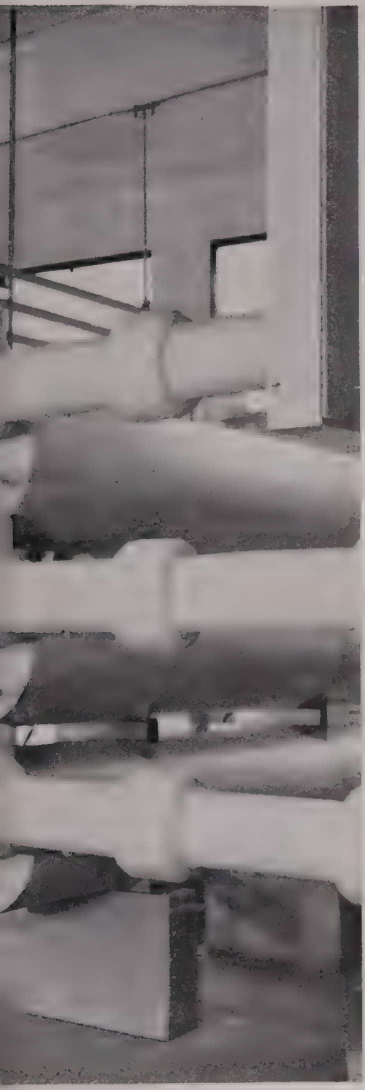

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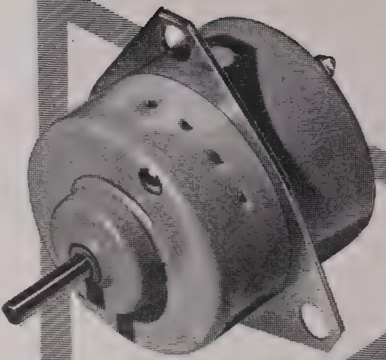
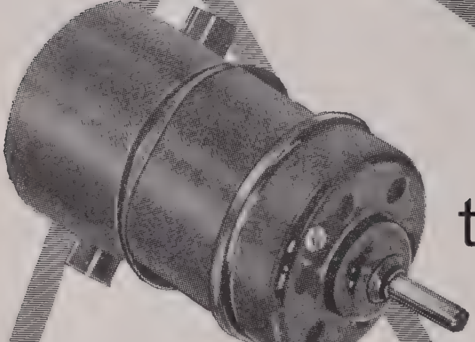


Delco 258 Type



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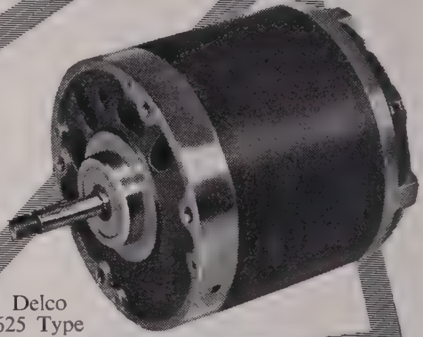

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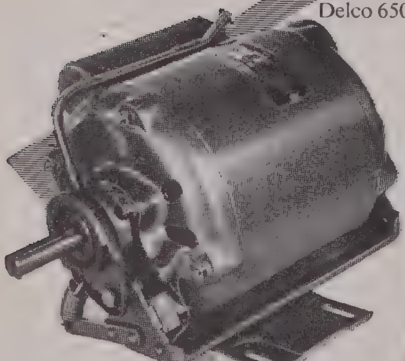

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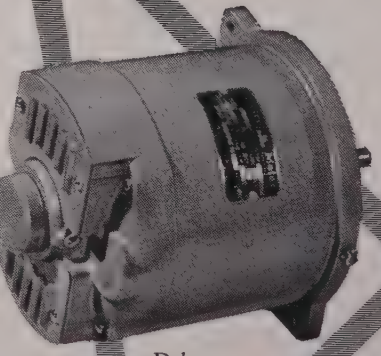

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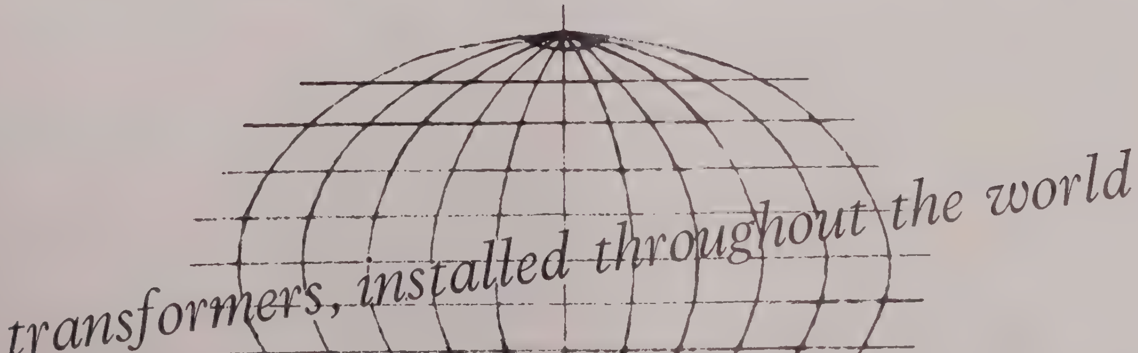
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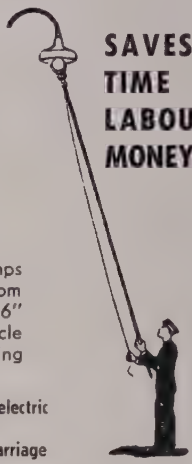

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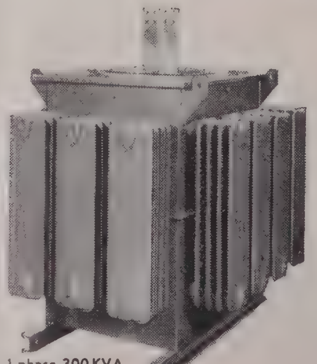

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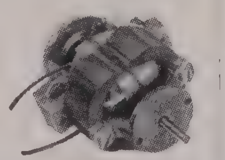

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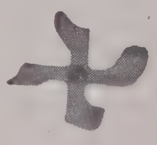

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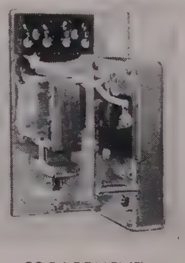

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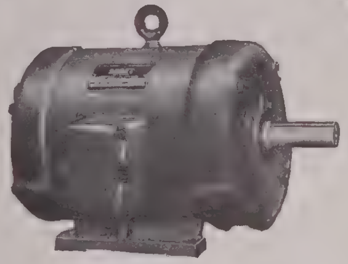

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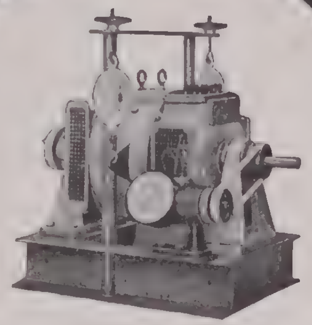

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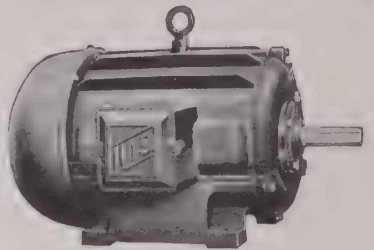

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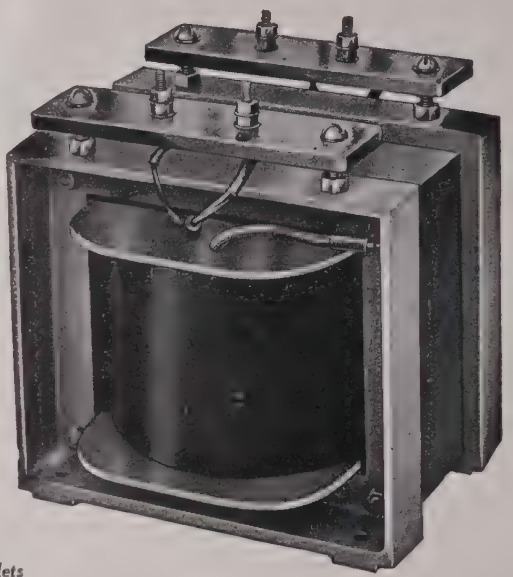

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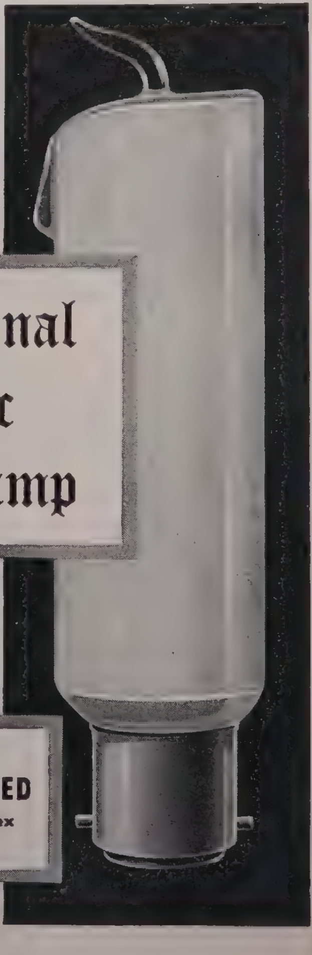

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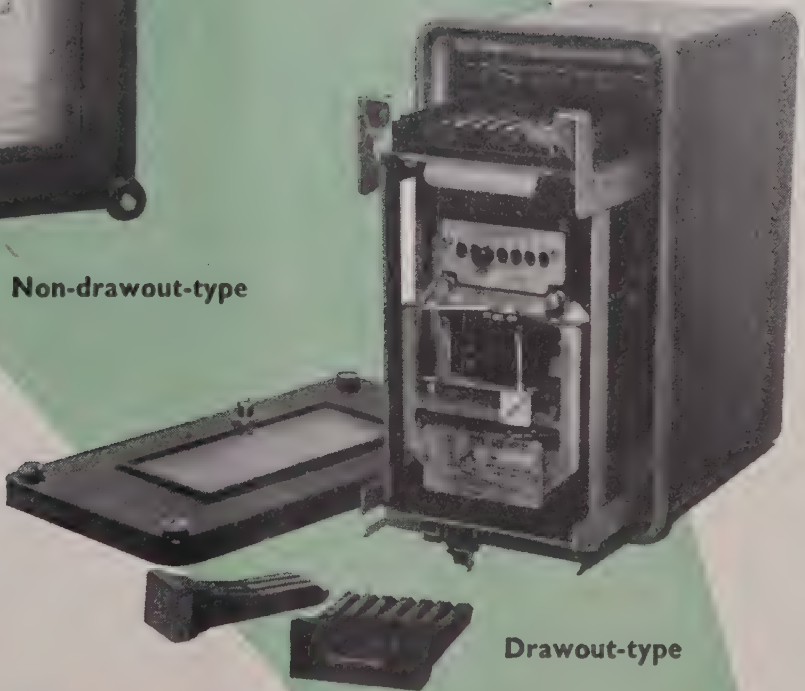

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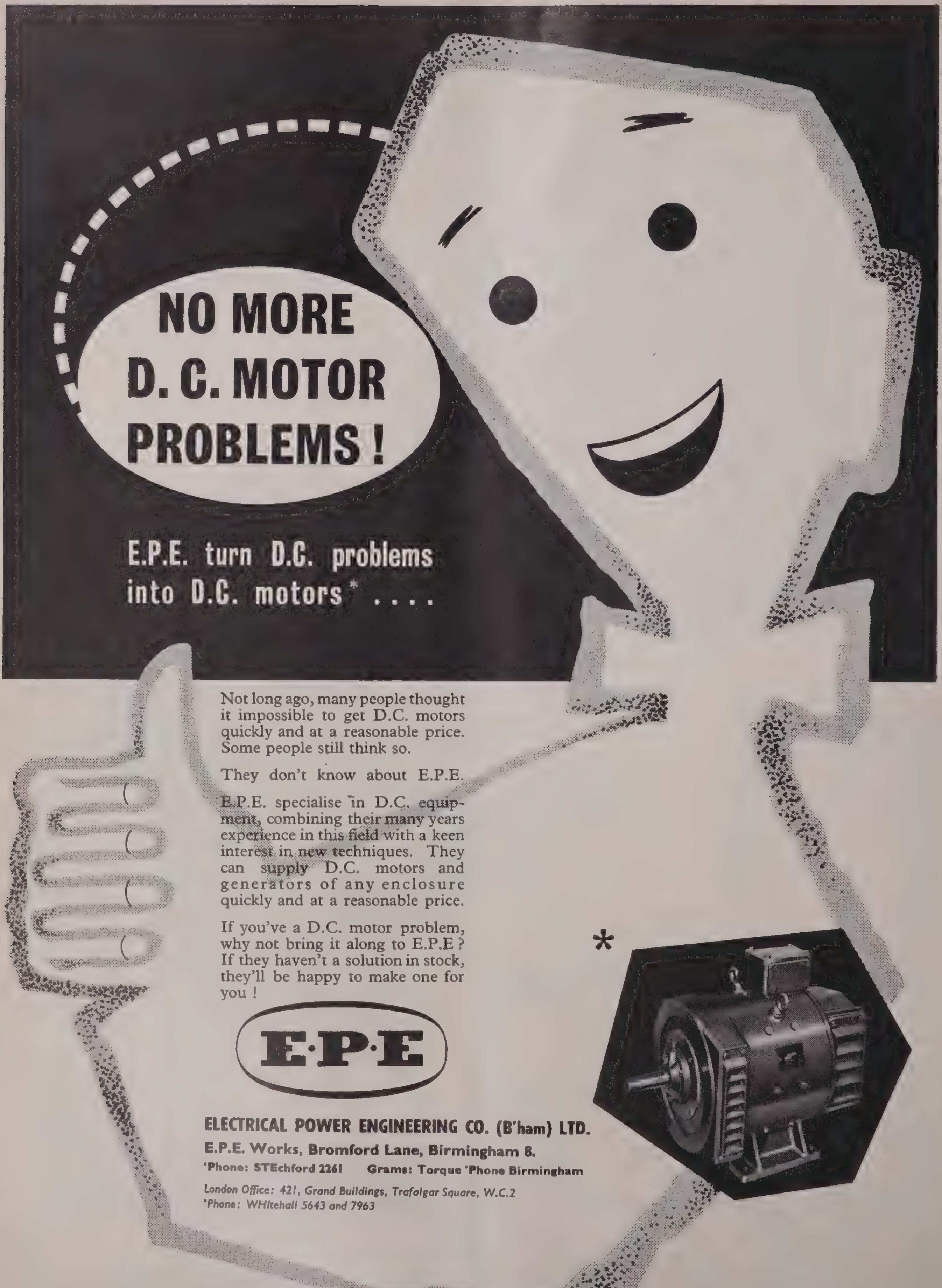
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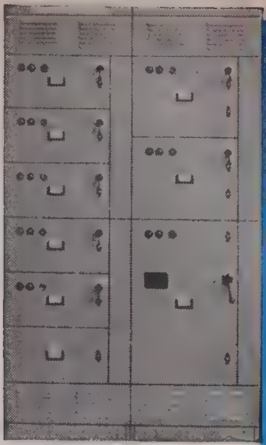

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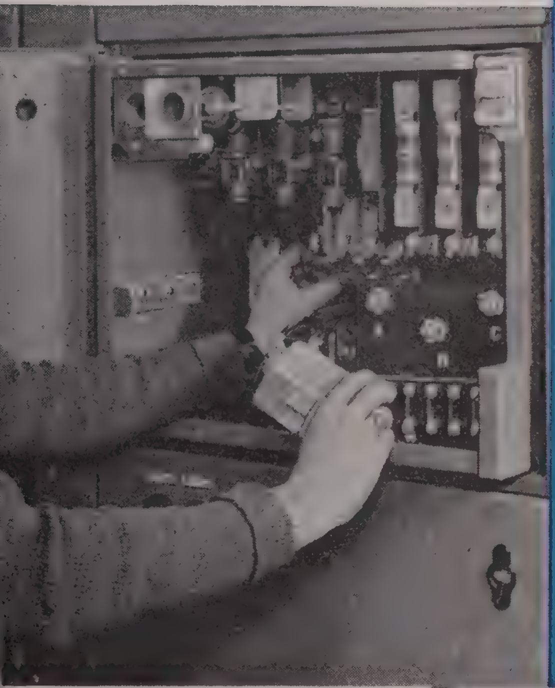

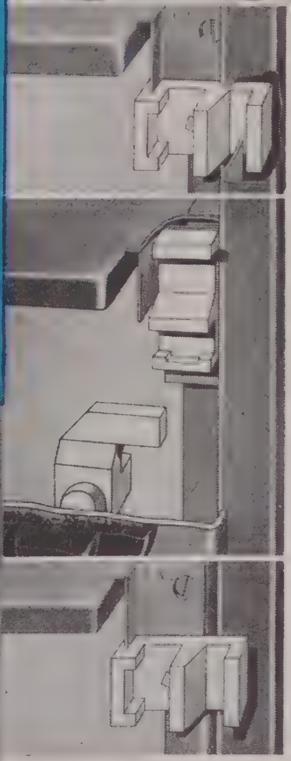

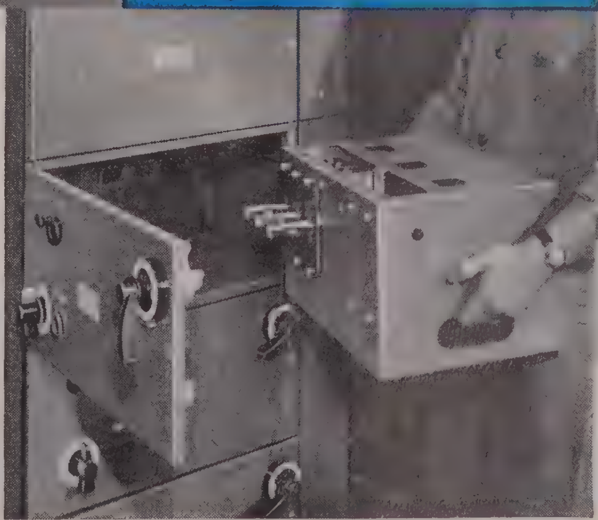

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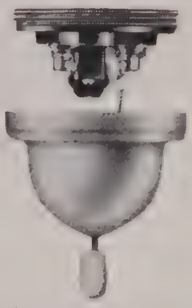

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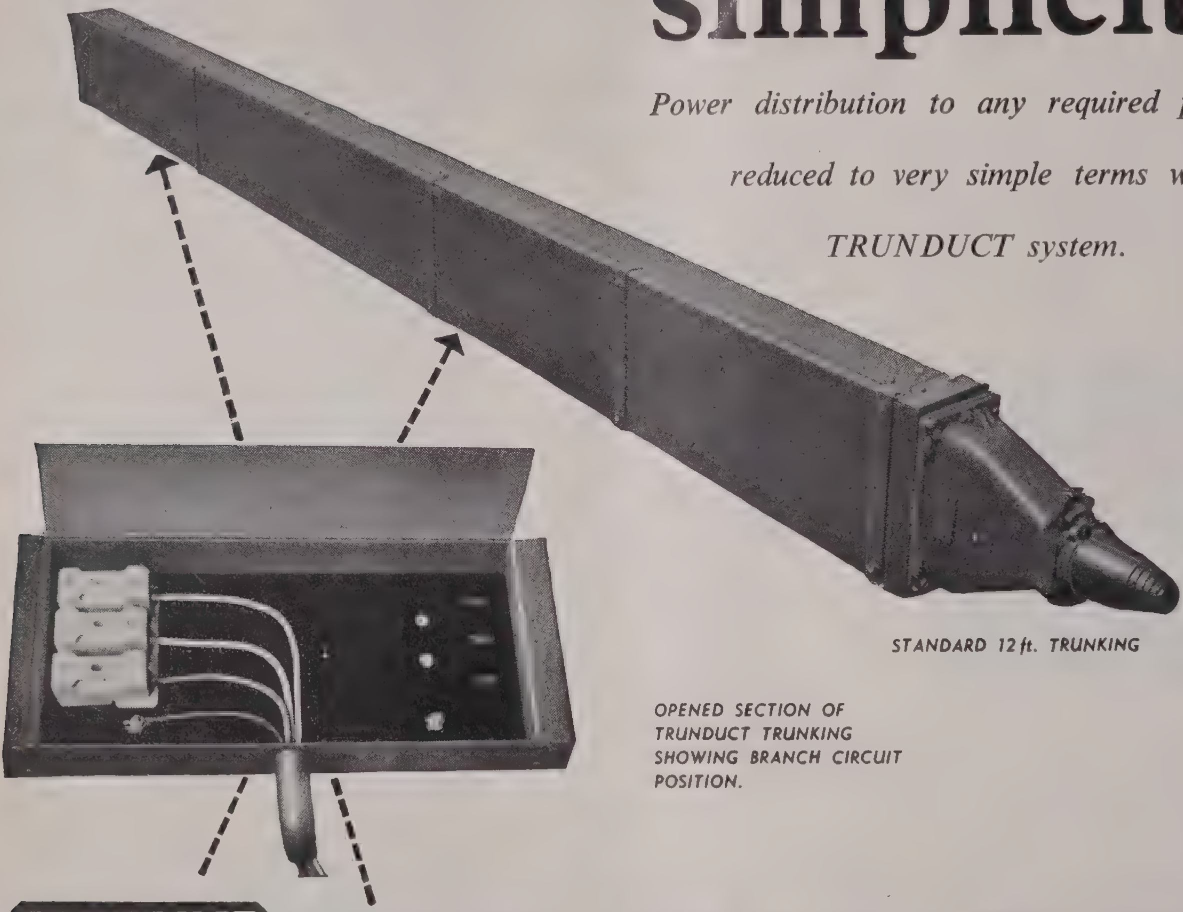

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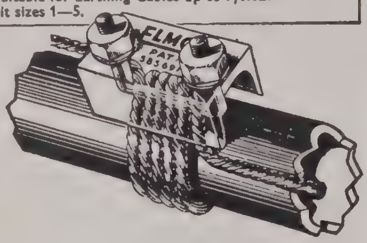
i.e. in trade terms	½" to ¾"	1" and 1¼"	1½" and 2"	2¼" to 3½"

NOTE ALSO: Type A123 is suitable for Earthing Cables up to 7/0.029" and for B.S. conduit sizes 1—5.



"Elmo" Earthing Clamps are of robust construction. Impossible for wire to pull out, always under tension, therefore a most satisfactory earth and a permanent safeguard.

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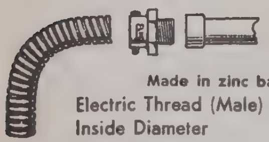
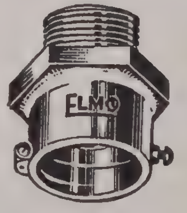


Flexible-to-rigid

CONDUIT COUPLINGS

Made in zinc base alloy in the following sizes:

Electric Thread (Male) ⅝" ¾" 1" 1¼" 1½" 2"
Inside Diameter ⅝" ¾" 1" 1¼" 1½" 2"
Electric Thread (Male) ⅝" ¾" 1" 1¼"
Inside Diameter Flexible Conduit ½" ⅝" ¾" 1"



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Special Features: Integral Earthing Terminal, tinned ready for soldering. Fixing screw for continuity. Internal Threads suit all makes of flexible tubing.

CONDUIT BUSHES

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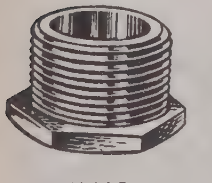
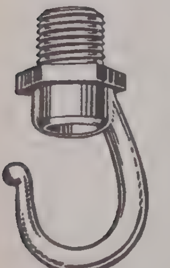
⅝" ¾" 1" 1¼" 1½" 2"
FEMALE: Electric Thread
⅝" ¾" 1" 1¼" 1½" 2"



MALE
Hex. Section

FEMALE
Flat Face Section for Spanner (except ⅝" size which is round)

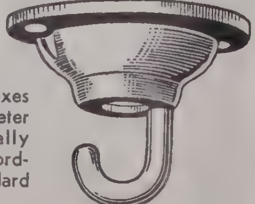
CONDUIT HOOK



For fluorescent lamps and overhead lighting fittings. Screwed ¾" thread, male electric.

CEILING PLATE

One hook



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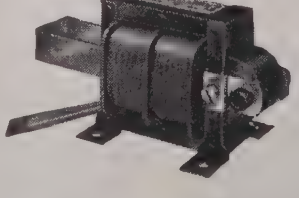

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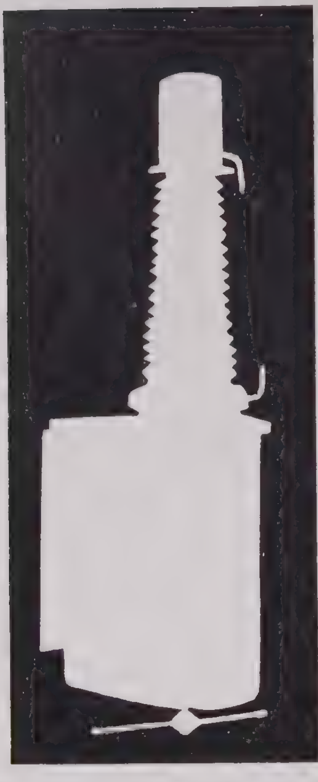

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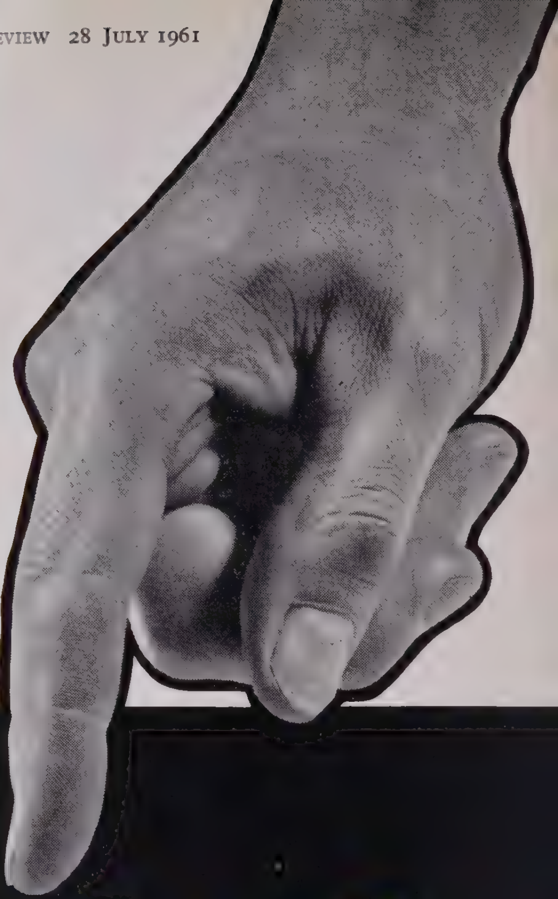

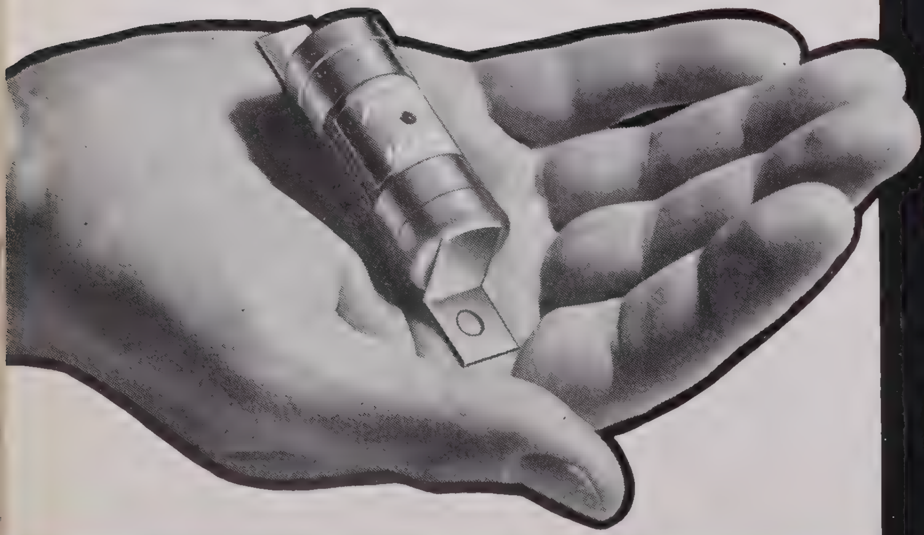

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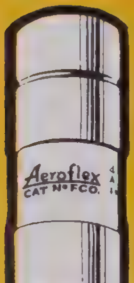

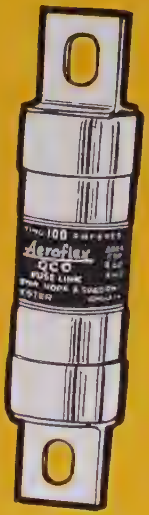

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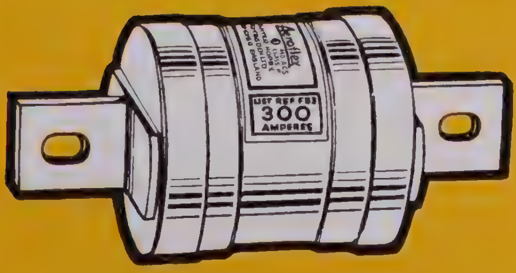

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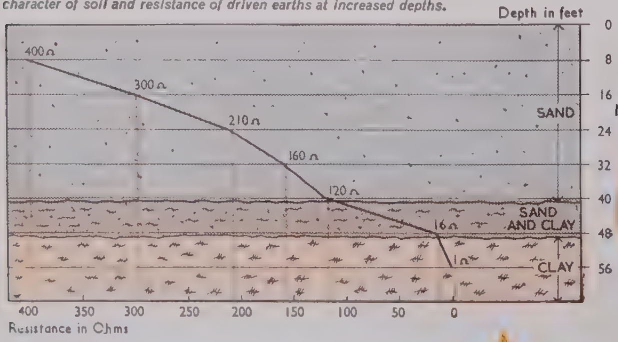

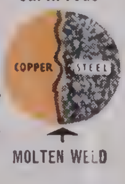

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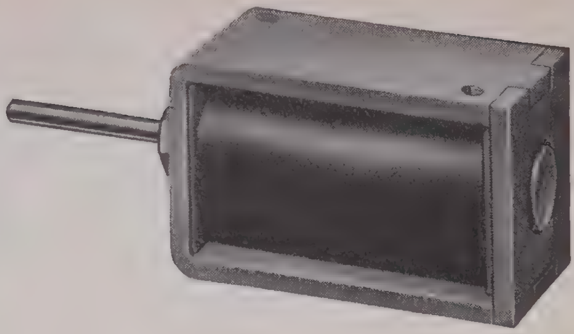

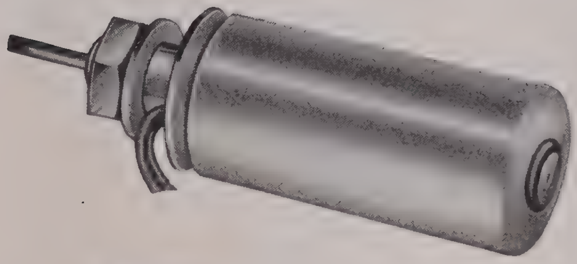

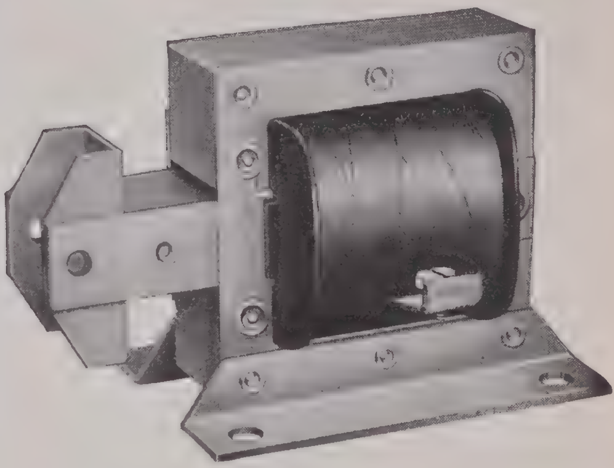

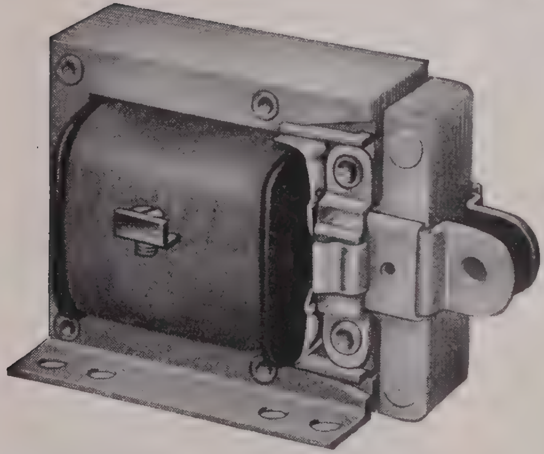

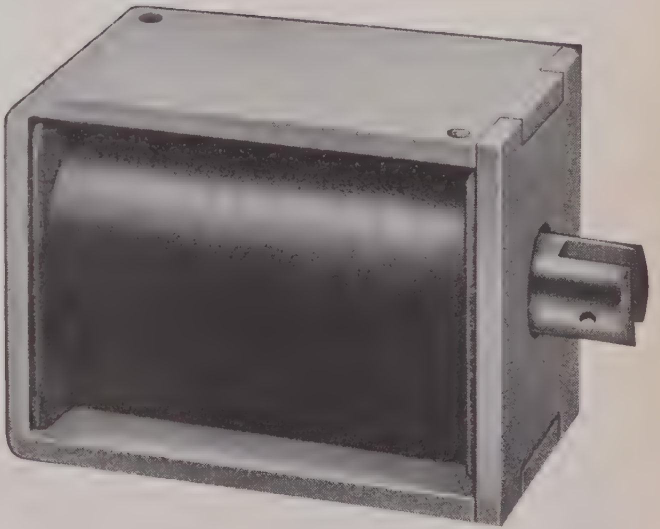

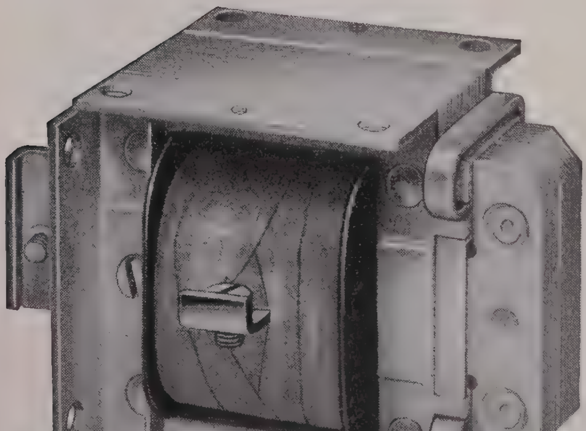

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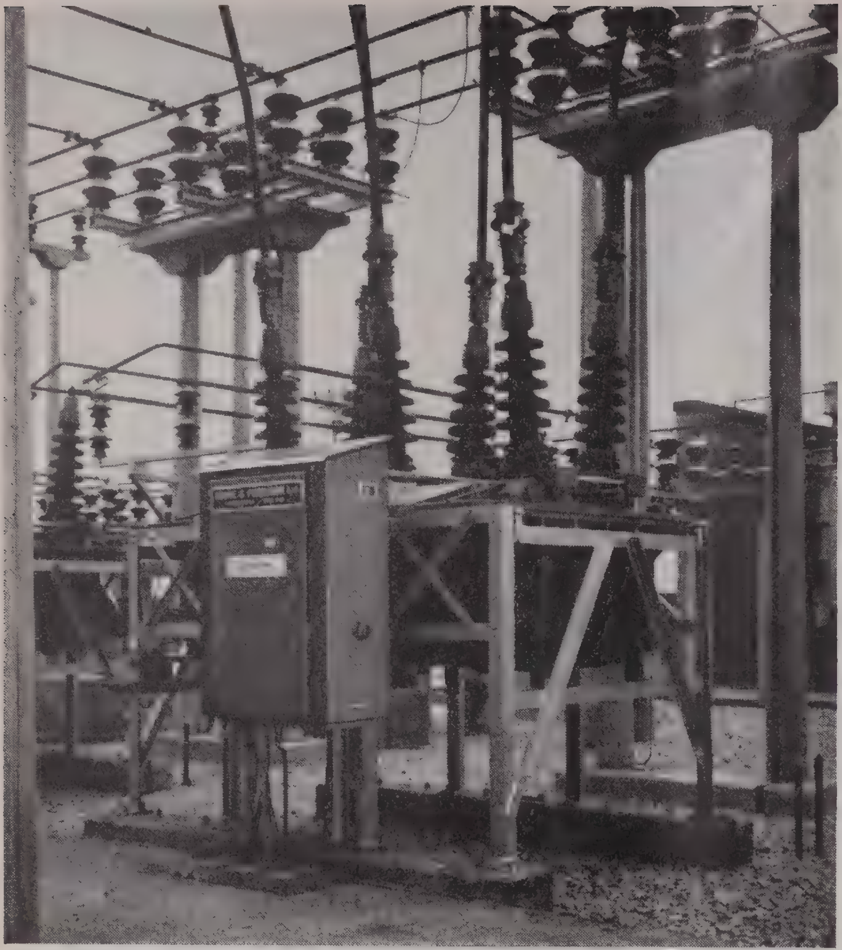

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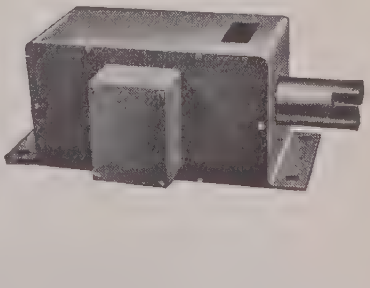

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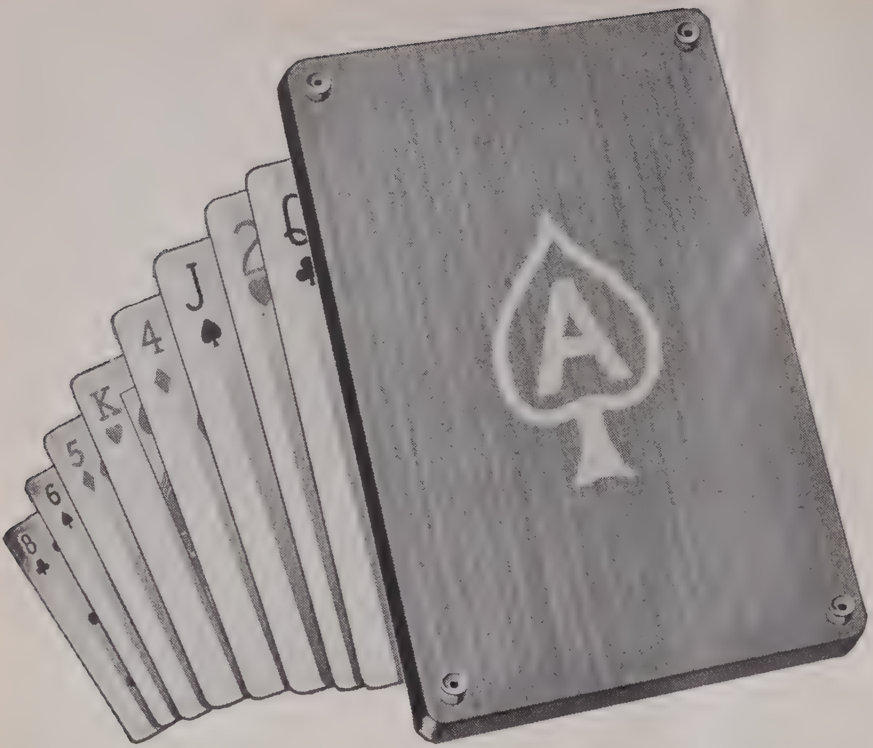

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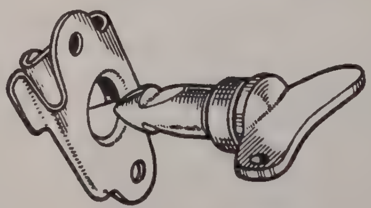

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1N2379	4000	100	50	10	100	12.0	
1N2380	6000	100	50	10	100	18.0	
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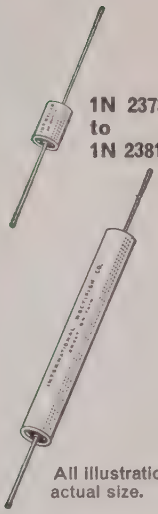

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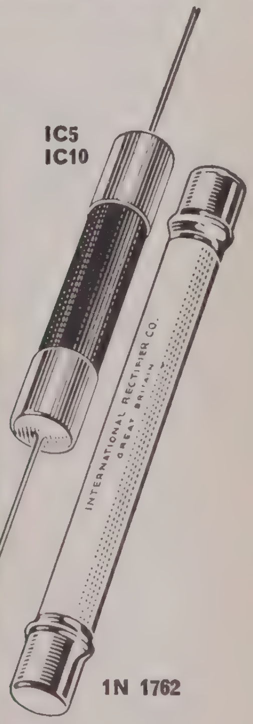

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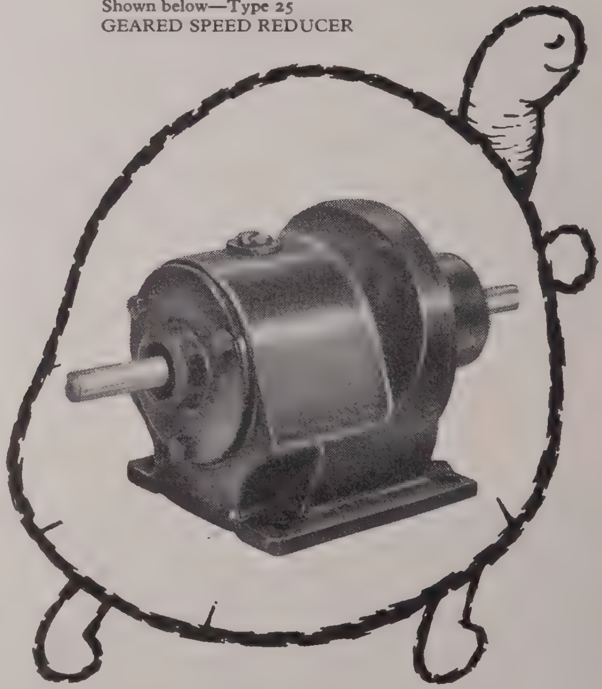

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Tenders received in any other manner will not be considered and the Electricity Corporation of Nigeria does not undertake to accept the lowest or any tender.

G. W. E. NICOL,
Secretary to the Corporation.

1814

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Class 2, B.640 (Hornsey Lane)

TENDERS are invited for the removal of the existing lighting systems and the supply and erection of 72 200-w. Sodium Units on 30-ft. steel columns and 46 140-w. Sodium Units on 25-ft. steel columns.

Specification and bill of quantities may be obtained from the Borough Engineer and Surveyor, Town Hall, Crouch End, Hornsey, London, N.8, and drawings may be viewed at this address.

Tenders must be returned in the envelope provided, bearing no mark or indication of the identity of the sender, and to be received by me not later noon on Friday, 18th August, 1961.

W. B. MURGATROYD,
Town Clerk.
1767

BRECONSHIRE COUNTY COUNCIL

TENDERS are to be invited from approved contractors enrolled with the National Inspection Council for Electrical Installation Contracting for the purpose of placing a sub-contract under a General Contractor for the ELECTRICAL INSTALLATION at the Five Stream Comprehensive Mixed School, Brynmawr. The floor area of the school is approximately 64,500 sq. ft. and comprises the following accommodation :—

22 GENERAL CLASSROOMS, 8 LABORATORIES, ENGINEERING WOODWORK AND METALWORK ROOMS, DRAWING OFFICE, 1 ASSEMBLY/DINING ROOM, 2 GYMNASIUMS, KITCHEN AREA, 1 STAGE MUSIC ROOM, 2 ART AND CRAFT ROOMS, 2 HOUSECRAFT ROOMS, LIBRARY, BOILER HOUSE, DIVISION ROOM, STAFF ROOMS, CHANGING ROOMS, CLOAKROOMS, ENTRANCE HALL, CORRIDORS, etc.

All Electrical Contractors desirous of tendering for the sub-contract are invited to submit their names and particulars to the County Architect, Rhyd Offices, Brecon, by 8th August, 1961, together with a deposit of two guineas. Cheques should be made payable to the Breconshire County Council.

The Breconshire County Council does not bind itself to accept the lowest or any tender.

C. M. S. WELLS,
Clerk of the County Council.

County Hall,
Brecon.
1787

INDIA STORE DEPARTMENT

THE Office of the Chief Engineer, Hydro-Electric Construction Projects, Post Bag No. 60, Bangalore, 1, India, invites tenders for the following :—

TENDER ENQUIRY No. HCP/SVHEP/1: For the supply of one 30-MVA Synchronous Condenser, starting switchgear and control panels for Bangalore Receiving Station.

A limited number of specifications are obtainable from the Co-ordination Branch, India Store Department, Government Building, Bromyard Avenue, Acton, London, W.3, at a cost of Rs.50/-, i.e., £3 15s. per set, which is not returnable. Further copies of the specification can be had from the Chief Engineer, Hydro-Electric Construction Projects, Race Course Cross Road, Post Bag No. 60, Bangalore, 1, India, on payment of the fee mentioned above.

Tenders are to be returned direct to the Chief Engineer, Hydro-Electric Construction Projects, at the address given above and NOT to this Office, and should reach him by 3 p.m. on 15th September, 1961.

Specimen copy of this enquiry can be seen at Engineering Branch, India Store Department, Acton, London, W.3, under the following reference number S.3323/61/NSC/ENG.2.

1786

CLASSIFIED ADVERTISEMENTS
ARE PREPAID

Advertisements are accepted up to **first post on Monday** of the week of issue
If blocks, bold type or ruled borders are required then on **Friday** prior to week of issue

11th AUGUST ISSUE

Classified Advertisements for the issue of 11th August should reach us by FRIDAY, 4th AUGUST. If blocks, bold type or ruled borders are required then on THURSDAY, 3rd AUGUST

All communications to be addressed to:
Classified Advertisement Department,
ELECTRICAL REVIEW
Dorset House, Stamford Street
London, S.E.1

Original testimonials should not be sent with applications for employment

SITUATIONS VACANT

(See "Replies to Box Numbers" above)

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Region

Nuclear Power Station Appointments
(a) Station Superintendent, Sizewell, Suffolk
(b) Deputy Station Superintendent, Dungeness, Kent

1. Applications are invited for the undermentioned appointments :—

(a) STATION SUPERINTENDENT, SIZEWELL, SUFFOLK.

Applicants should have a thorough technical and practical training followed by wide experience in the management, operation and maintenance of modern power station plant. Importance will be attached to the financial and human relations aspects of such operation, and the successful candidate would be expected to have vision and adaptability to new ideas.

After receiving any nuclear training considered necessary the successful candidate for this position would be required to spend a period of approximately 12 months with the Nuclear Operations Engineer at Board Headquarters, Friars House, London, S.E.1, after which he would take up duties at the site.

The provisional salary for this post will be £3,300 per annum.

(b) DEPUTY STATION SUPERINTENDENT, DUNGENESS.

Applicants should have a thorough technical and practical training followed by wide experience in the operation and maintenance of modern power station plant. Importance will be attached to the financial and human relations aspects of such operation.

The salary for this post will be within the range of £2,355 × £45 to £2,490 per annum.

2. Applicants for both positions should preferably possess a University Degree in relevant subjects and be Corporate Members of the Institution of Mechanical Engineers and/or the Institution of Electrical Engineers.

3. Though knowledge of nuclear technology is desirable, this is not essential, as suitable training can be given.

4. Applications, quoting Vacancy Number S.E.36/61, and clearly endorsed on the envelope with the post applied for, should be forwarded to the Regional Secretary, South Eastern Region, Ergon House, Horseferry Road, London, S.W.1, not later than 11th August, 1961.

1757

***Situations Vacant** (continued)*

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Region

East Midlands Division

SHIFT CHARGE ENGINEER,
WARWICK POWER STATION
(Vacancy No. 169/61).

Applications are invited from qualified engineers for the position of Shift Charge Engineer at Warwick Power Station, Emscote Road, Warwick. Applicants should have had experience in the operation of steam turbine and boiler plant.

Salary will be in accordance with Class E, Grade 7 (£965 - £1,090 per annum) of the National Joint Board Agreement plus 10% allowance for shift duties.

Closing date for receipt of applications, 4th August, 1961.

ASSISTANT EFFICIENCY ENGINEER,
NOTTINGHAM POWER STATION
(Vacancy No. 170/61).

Applications are invited for the position of Assistant Efficiency Engineer at Nottingham Power Station, Queens Drive, Nottingham. Applicants should have held a position of responsibility in a modern power station and should have received a thorough practical and theoretical training.

Preference will be given to candidates who are corporate members of a recognised professional institution or who hold qualifications leading to such membership.

Salary will be in accordance with Class K, Grade 8 (£1,275 - £1,410 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 4th August, 1961.

ASSISTANT SHIFT CHARGE ENGINEER,
COVENTRY POWER STATION
(Vacancy No. 171/61).

Applications are invited for the position of Assistant Shift Charge Engineer at Coventry Power Station, Alderman's Green, Coventry.

Applicants are required to take charge of shift operation of boiler house plant and must possess a sound technical training, a good general engineering experience, and knowledge of the control and operation of water tube boilers, ancillary plant and the efficient combustion of chain grate stokers.

Salary will be in accordance with Class G, Grade 9 (£965 - £1,090 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 4th August, 1961.

SHIFT CHARGE ENGINEER,
SPONDON POWER STATION
(Vacancy No. 173/61).

Applications are invited for the position of Shift Charge Engineer at Spondon Power Station, Thulston Road, Borrowash, near Derby. Applicants should have had a sound training and considerable experience in a modern generating station.

Preference will be given to candidates who are Graduate Members of the Institution of Electrical or Mechanical Engineers, or who hold similar qualifications.

Salary will be within Class J, Grade 6 (£1,350-£1,500 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 11th August, 1961.

SHIFT CONTROL ENGINEERS,
NOTTINGHAM POWER STATION
(Vacancy No. 174/61).

Applications are invited for the position of Shift Control Engineers at Nottingham Power Station, Queens Drive, Nottingham. Applicants should have had a sound training and practical experience in a modern power station. Possession of Higher National Certificate, or equivalent, will be an advantage.

Salary will be in accordance with Class K, Grade 10 (£1,115-£1,245 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 11th August, 1961.

These appointments are pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Station Superintendent concerned and returned to him by the specified date.

O. S. WOODS,
Assistant Regional Director.
1807

SENIOR TRANSFORMER DESIGNER
with experience of various types up to 5 MVA. This appointment carries a very realistic salary and scope for the future for the right man between 30-40.

A company house is available if required. Factory is situated in ideal rural surroundings four miles from the sea.

Apply Chief Designer, London Transformer Products Ltd., Bridgend, Glam. 206

ENGLISH ELECTRIC

WHETSTONE, NR. LEICESTER

Atomic Power Division have a vacancy for a

SENIOR ELECTRICAL ENGINEER

with experience of heavy electrical construction work on site, of which experience of cabling and switchgear would be particularly advantageous. Associate or Grad. I.E.E. essential.

The successful applicant will be required to liaise between headquarters at Whetstone and Nuclear Power station sites in order to ensure the electrical aspects of the power station constructional programme are completed ahead of schedule.

Applications (which will be treated in confidence) should be addressed to the Chief Engineer, Atomic Power Division, c/o Dept. G.P.S., English Electric House, Strand, London, W.C.2, quoting reference number ER1888N.

1759

SOUTH EASTERN ELECTRICITY BOARD

ASSISTANT DISTRICT ENGINEER,
Crawley and Horsham.

Salary within the range £965-£1,090 under N.J.B. Class F, Grade 8. Applicants should be suitably qualified and have had training and experience in the construction, operation and maintenance of underground and overhead distribution systems up to 11 kV. The successful applicant will be required to reside within the district and undertake standby duties. Subject to certain conditions housing accommodation will be available in Crawley.

Applications, quoting ER and naming 2 referees, to District Manager, SEEBOARD, 50/52, The Broadway, Crawley, by 9th August, 1961.

ASSISTANT DISTRICT ENGINEER,
Maidstone District.

Salary under N.J.B. Class F, Grade 9, £890 × £25 to £1,015 p.a. Superannuable. Applicants should have had a good general education, be technically trained to H.N.C. standard and have had practical experience in general distribution work on H.V. and L.V. systems. Knowledge of the preparation of system extension and reinforcement proposals an advantage.

Applications, quoting ER and naming 2 referees, to District Manager, SEEBOARD, Fairmeadow, Maidstone, by 9th August, 1961.

SHOWROOM ASSISTANT (Male),
Crawley and Horsham District.

Annual salary subject to age, qualifications and experience up to N.J.C. Grade 1, at present a maximum of £700 p.a. Duties will include general showroom work, advising consumers on the use of electrical apparatus. The appointment will be made at Horsham showroom, but the successful applicant may be required to work at times in the Crawley showroom. He may also be required to carry out relief cashier duties.

Applications, quoting ER and naming 2 referees, to District Manager, SEEBOARD, 50/52, The Broadway, Crawley, by 11th August, 1961.

CHARGEHAND LINESMAN
(Overhead Power), Hastings District.

Wages 5s. 8½d. per hour for a 42-hour 5-day week under N.J.I.C. Agreement. The successful applicant will be based at Parker Road, Depot, Hastings, and will be required to carry out and supervise all work in connection with the erection and maintenance of overhead lines, distribution and service work up to 11 kV and equipment or apparatus associated with such work.

Applications, quoting ER, on forms from District Manager, SEEBOARD, 12/13, York Buildings, Hastings, by 8th August, 1961.

GEORGE WRAY,
Secretary.
1796

WESTERN REGIONAL HOSPITAL BOARD

Regional Engineer's Department

APPLICATIONS are invited for the post of PRINCIPAL ASSISTANT ENGINEER (Electrical). Salary £1,665 × £50 (1) × £75 (2) × £85 (2) to £2,035 per annum. The appointment is superannuable and subject to Whitley Council Conditions of Service.

Applicants must be Corporate Members of the Institution of Electrical Engineers and must have considerable experience in the design, estimating and preparation of specifications and schedules to cover all types of electrical installation work, including power, lighting, heating, lifts, call systems and telephones.

Experience in the supervision of technical staff is also desirable.

Applications, stating age, qualifications, experience, present and previous posts, and names and addresses of three referees, should be forwarded to the Secretary, Western Regional Hospital Board, 351, Sauchiehall Street, Glasgow, C.2, before 25th August, 1961. 1746

AEI PROCESS CONTROL

REPRESENTATION

SALES ENGINEER

(NORTH MIDLAND REGION)

to work in the Regional sales office. Qualifications: H.N.C. or equivalent and wide experience in Process Control engineering covering the sale of components and the handling of process control schemes.

Attractive salary and a comprehensive pension scheme covering both the man and his wife.

Applications to :- **The Regional Manager,**
North Midlands Region,
A.E.I. Home District Offices,
9, Market Place, SHEFFIELD.

1760

CITY OF SALISBURY, SOUTHERN RHODESIA

Vacancy for Senior Electrical Engineer

Salary Scale £1,768 2s. 6d. × £51 5s. to £1,921 17s. 6d. per annum

APPLICATIONS are invited for the position of a Senior Electrical Engineer on the salary scale £1,768 2s. 6d. × £51 5s. to £1,921 17s. 6d. per annum, commencing salary at the minimum of the grade. No allowances are payable.

Candidates should possess a Degree in Electrical Engineering or the equivalent, and/or be Corporate Members of the British Institution of Electrical Engineers, and have at least 15 years' experience in the design, erection and maintenance of indoor and outdoor substations, transformers, switchgear, protection, etc., up to and including 33,000 volts. Experience on 88 and/or 132-kV equipment will be an advantage.

The selected candidate will be deputy and assistant to the engineer in charge of the substation section of the distribution branch of an undertaking covering approximately 600 square miles and some 1,200 substations, with a present system maximum demand of 120 MW, but may be assigned to such other duties as requisite in the distribution section. Experience in general distribution work, and in the control of staff in an organisation of similar size, is essential.

GENERAL. The successful candidate will be required to furnish to the Council a satisfactory medical certificate of fitness and to serve a probationary period of not less than six months and if thereafter confirmed in his appointment, to join the Southern Rhodesia Local Authorities Joint Pension and Widows and Orphans Fund.

Candidates must submit full particulars of their qualifications, training and experience, giving details of positions held and salaries received. Age, nationality and marital state should be stated and copies of not more than three recent testimonials may be forwarded.

Particulars of the undertaking and a summary of conditions of service, pension and leave entitlements, etc., may be obtained from Messrs. Merz & McLellan, Carliol House, Newcastle upon Tyne, 1, to whom applications must be submitted on or before 18th August, 1961.

1797

YORKSHIRE ELECTRICITY BOARD

No. 6 (Hull) Sub-Area

SENIOR ASSISTANT ENGINEER
(Commercial).

Applicants must be experienced in all matters relating to the administration and operation of a Sub-Area commercial department.

The duties of the post will include development of supply, utilisation, negotiations with large industrial and commercial consumers, and generally to co-ordinate the activities of the commercial engineering staff of the Sub-Area.

Salary N.J.B. Class L, Grade 4 (Scale 16), £1,795/£1,950 per annum.

Applications, together with the names of two referees, should be sent to the Manager, No. 6 (Hull) Sub-Area, Yorkshire Electricity Board, Ferensway, Hull, not later than 11th August, 1961.

No. 2 (Huddersfield) Sub-Area

THIRD ASSISTANT ENGINEER
(Draughtsman).

Applicants should have a sound knowledge of drawing office practice, experience in the preparation of plant layout drawings, working drawings and wiring diagrams, and should be capable of supervising the electrical section of the Sub-Area drawing office, including mains records.

Salary N.J.B. Class L, Grade 10 (Scale 10), £1,190/£1,325 per annum.

HUDDERSFIELD DISTRICT

FOURTH ASSISTANT DISTRICT ENGINEER.

Applicants should have had experience in the design, construction, operation and maintenance of H.V. and L.V. overhead and underground distribution systems, substation plant and ancillary equipment.

Salary N.J.B. Class J, Grade 11 (Scale 7), £965/£1,090 per annum.

Applications, together with the names of two referees, should be sent to the Manager, No. 2 (Huddersfield) Sub-Area, Yorkshire Electricity Board, Market Street, Huddersfield, not later than 11th August, 1961.

1803

CENTRAL ELECTRICITY GENERATING BOARD

Southern Project Group

Dungeness Nuclear Power Station

APPLICATIONS are invited from suitably qualified and experienced engineers for appointments at Dungeness Nuclear Power Station Construction Site. Experience in the supervision of construction of major engineering works and in the installation of power station plant would be an advantage.

SECOND ASSISTANT ENGINEER
(Electrical).

THIRD ASSISTANT ENGINEER
(Electrical).

To assist the Site Electrical Engineer in the supervision of the installation and commissioning of all electrical engineering plant.

THIRD ASSISTANT ENGINEER
(Mechanical).

To assist the Site Mechanical Engineer in the supervision of the installation and testing of mechanical engineering plant—conventional and nuclear.

Salaries will be within the following scales of the National Joint Board Agreement, Schedule C :—

Second Assistant Engineer :
Scale 15, £1,460 to £1,830 per annum.
Third Assistant Engineer :
Scale 13, £1,320 to £1,610 per annum.

The successful candidates will be required to live in the vicinity of the site for the duration of the construction work, which will be up to four or five years. Opportunities will be available for transfer to future construction sites and associated design teams.

Applications, stating age, qualifications, experience, present position and salary should be forwarded to the Administrative Officer, Central Electricity Generating Board, Southern Project Group, Squires Lane, Finchley, London. N.3, to arrive not later than Wednesday, 9th August, 1961.

Envelopes should be marked "Confidential, ref. S/61/14."

T. YULE,
Chief Project Engineer.

1780

SIMON-CARVES LIMITED

require an

ASSISTANT ELECTRICAL ENGINEER

for work on Power Station Auxiliary Equipment, comprising selection of motors, starters, switchgear and cabling, control and interlocking schemes for steam raising plant and complete power stations.

The preparation of estimates, contract engineering and some site commissioning will be involved.

Applicants should have a sound technical background, including a recognised apprenticeship, and be qualified to at least H.N.C. level.

Although experience of this type of work is desirable it is not essential, and suitably qualified applicants will be trained.

This is a permanent, pensionable post carrying a commencing salary in the range £1,000/£1,500 per annum.

Send brief relevant details to :—

Personnel Department
SIMON-CARVES LIMITED
Cheadle Heath, Stockport, Cheshire
quoting Ref. SC.40/4.

1799

***Situations Vacant** (continued)*

EAST MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited from suitably qualified and experienced persons for the following appointments. Applicants should state age, qualifications, experience, etc., and quote appropriate vacancy number.

Derby and Burton Sub-Area

FOURTH ASSISTANT DISTRICT
COMMERCIAL ENGINEER,
BURTON DISTRICT
(Vacancy No. 90/61).

Salary N.J.B. Class G, Grade 12, £765 to £870 per annum.

Duties will include assisting in the negotiations for the supply of electricity to agricultural, commercial, domestic and industrial consumers and the change-over of consumers' apparatus to standard voltage.

The successful candidate will also be required to supervise installation work and to advise consumers on tariffs, electrical installations and appliances, sales activities and general consumer service.

Applicants should preferably have received an engineering training and should have a good knowledge of the Board's tariffs, the I.E.E. regulations and modern installation practice. Ability to drive a car would be an advantage.

Applications stating age, qualifications and experience, previous and present appointments should be forwarded to the Manager, Derby and Burton Sub-Area, Electricity Offices, Irongate, Derby, in a confidential envelope endorsed "Fourth Assistant District Commercial Engineer, Burton," by the 18th August, 1961.

Area Board Headquarters

FOURTH ASSISTANT ENGINEER
(Technical) (Vacancy No. 91/61).

Salary N.J.B. Class BX, Grade 10, £935 to £1,245 per annum, or Class BX, Grade 9, £1,005 to £1,325 per annum, depending on the experience and qualifications of the successful candidate.

The duties of the post include assisting in the analysis and preparation of reports on the performance of the system and items of plant, and tests on various types of equipment.

Applications stating age, qualifications, education, experience, present and previous positions and salaries should be addressed to the Chief Engineer, East Midlands Electricity Board, Mapperley Hall, Nottingham, by 18th August, 1961.

1812

CITY OF SHEFFIELD

City Architect's Department

Appointment of Assistant Engineer (Electrical), Grade A.P.T. III (£960 - £1,140)

APPLICATIONS are invited for this appointment on the permanent staff of the City Architect, Mr. J. L. Womersley.

Applicants should possess the Higher National Certificate in Electrical Engineering, should have had a sound technical training, some knowledge of installation practice in large buildings, be good draughtsmen, and capable of preparing drawings and specifications under limited supervision.

Commencing salary within the above grade commensurate with the successful applicant's qualifications and experience.

Applications stating age, education, training, qualifications, experience, present and past appointments (with dates and salaries), and the names and addresses of two referees, should reach me by Friday, 11th August.

JOHN HEYS,
Town Clerk.

Town Hall,
Sheffield, 1.

1771

'ENGLISH ELECTRIC'

WHETSTONE, NR. LEICESTER

ELECTRICAL AND INSTRUMENT ENGINEERS

Vacancies have arisen for Electrical and Instrument plant contract engineers to negotiate the procurement of electrical plant, instruments, cubicles and control gear for the Atomic Power Division. They will be required to negotiate within the Company as well as with subcontractors, and will be required to act on their own initiative. Experience with Power Station auxiliary equipment, instrumentation or control gear (as appropriate) is essential.

Please write, giving details of previous experience and qualifications, to the Chief Engineer, c/o Dept. G.P.S., English Electric House, Strand, London, W.C.2, quoting reference number ER1897T.

1778

SOUTH EAST LONDON TECHNICAL COLLEGE

Lewisham Way, London, S.E.4

Department of Electrical Engineering and Applied Physics

APPLICATIONS are invited for LECTURERS in ELECTRICAL ENGINEERING. Candidates should be well qualified and have had industrial experience in one or more of the following branches:

(a) Instrumentation and Control Systems.
(b) Light Current Electrical Engineering.
(c) Electronic Industrial Applications.
(d) Electrical Power Engineering.

The Department offers Full-time, "Sandwich" and Part-time Day and Evening Courses.

Salary £1,408 to £1,601 with possible entry above the minimum.

Application forms from the Secretary, returnable within two weeks, quoting (FE.3a/R/2086/7).

1820

A well-known, progressive company,
specialising in

HEAVY CAPITAL PLANT

requires an

ELECTRICAL ENGINEER

conversant with up-to-date equipment and control gear for rolling mills and auxiliary machinery.

The position will be that of ASSISTANT CHIEF ELECTRICAL ENGINEER.

Men up to 40 years of age are invited to apply giving full particulars of education, previous and present employers; a salary commensurate with experience will be paid.

Box 1781.

CENTRAL ELECTRICITY GENERATING BOARD

West Midlands Division

Assistant Engineers (District)

FOURTH ASSISTANT ENGINEERS required in Meaford (near Stoke-on-Trent), Bushbury (near Wolverhampton), Birmingham and Stourport Transmission Districts.

N.J.B. Agreement conditions, superannuable appointments, salary within Schedule B, Class CX, Grade 11, commencing at a figure commensurate with qualifications and experience. The salary range is £920-£1,245 per annum.

Candidates should preferably possess a Higher National Certificate in Electrical Engineering or equivalent qualification, and should have had some experience in protective gear, metering or communications equipment.

Successful candidates will have opportunity for interchange of duties associated with E.H.V. transmission plant.

Apply, quoting Vacancy No. 189/61MD, on form A.E.6, available from the Establishments Officer, 53, Wake Green Road, Moseley, Birmingham, 13, not later than 9th August, 1961.

1801

CENTRAL ELECTRICITY GENERATING BOARD

West Midlands Division

GENERAL ASSISTANT ENGINEERS are required in the Site Maintenance Department at Meaford "A," "B" and Stoke Power Station. N.J.B. service conditions, superannuable appointments. Salary according to Class L, Grade 15, Scale 5, £825-£940 per annum.

Candidates should preferably possess Higher National Certificate (Mechanical or Electrical), or equivalent, or be studying for one of these qualifications. The posts provide opportunities for gaining experience in plant operation and maintenance.

Applications, quoting Vacancy No. 196/61MD, to be made to the Station Superintendent, Meaford Power Station, nr. Stone, Staffs., by 9th August, 1961.

1800

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts :—

North Staffordshire Area

GENERAL ASSISTANT DISTRICT ENGINEER (Stoke South).

Duties include assistance on the planning, construction and maintenance of H.V. and L.V. overhead and underground mains. Technical qualifications desirable. Salary £825/£940 per annum (N.J.B. Grade G.11).

Apply by letter within 10 days, stating age, experience, present position and salary, to Mr. C. C. Pimble, Area Manager, Midlands Electricity Board, 234, Victoria Road, Fenton, Stoke-on-Trent.

South Staffs. and North Worcs. Area

FOURTH ASSISTANT ENGINEER (Meter and Special Test Section, Area Office).

Applicants should have a good knowledge of modern metering practice, be fully conversant with all types of H.V. metering equipment, and be able to undertake site tests and maintenance. Technical qualifications desirable. Salary £1,040/£1,165 per annum (N.J.B. Grade M.13).

Apply by letter within 14 days, quoting ref. SS/T/526, stating age, qualifications, experience, present position and salary, to Mr. D. Holt, Acting Area Manager, Midlands Electricity Board, P.O. Box No. 9, Toll End Road, Tipton, Staffs.

F. W. CATER,
Secretary.

1788

LONDON ELECTRICITY BOARD

Engineering Draughtsmen

APPLICATIONS are invited for the above vacancies in the Engineering Drawing Office at Lesco House, Stamford Street, London, S.E.1.

Duties will include the surveying on site and constructional details in connection with the laying of E.H.V. transmission cables.

Candidates should have received a good general and technical education and possess the O.N.C. in Electrical or Mechanical Engineering. They should preferably be not less than 22 years of age.

The posts are graded under Schedule B of the National Joint Board Agreement as Class BX, Grade 13, £820 per annum rising to £1,065 per annum, inclusive of London allowance.

Application forms obtainable from the Personnel Officer, 46, New Broad Street, London, E.C.2, to be returned completed within fourteen days of the publication date of this notice. Please quote ref. PER/V/3366/R.

1809

MARRYAT & PLACE LTD.

require PERSONAL ASSISTANT TO TECHNICAL DIRECTOR. Excellent salary and prospects for man of good education with sound technical training and practical experience in contracting industry.

Applications from men not less than 28 or over 32 years of age, giving full details and salary required, should be made to 40, Hatton Garden, London, E.C.1.

1764

LONDON ELECTRICITY BOARD

Senior Draughtsman

APPLICATIONS are invited for the above position in the Board's Southern District at 54, Bengeworth Road, London, S.E.5.

Applicants should have had a good general and technical education and possess the Ordinary National Certificate or its equivalent, and be capable of supervising engineering draughtsmen and other drawing office staff. They should also have had experience in building construction, including reinforced concrete design, be able to prepare working drawings and structural calculations in connection with the conversion of existing premises into transformer chambers, together with the layout of electrical equipment and cabling.

The post is graded under Schedule A of the National Joint Board Agreement as Class J, Grade 10, £1,090 to £1,215 per annum, inclusive of London allowance.

Applications stating age, qualifications and experience, should be sent direct to the Manager, at 54, Bengeworth Road, London, S.E.5, within fourteen days of the publication date of this notice. Please quote ref. PER/V/3327/R.

1810

ELECTRICAL AND MECHANICAL ENGINEER

Government of Aden, Public Works Department

QUALIFICATIONS: Candidates must be A.M.I.Mech.E. or A.M.I.E.E. with 10 years' extensive experience in electrical and mechanical engineering.

Duties: To take charge of the electrical and mechanical branches of the department and to advise the Director of Public Works on technical matters in those spheres.

Terms of Appointment: Contract for 18-24 months.

Total Emoluments (salary and gratuity) in scale £1,677 - £2,710.

Children's allowances. Free passages. Outfit allowance. Married quarters available at moderate rental.

Write Director of Recruitment, Colonial Office, London, S.W.1, giving full names, age, qualifications and experience, quoting reference BCD.112/2/018/D.11.

1790

ELECTRICAL ENGINEER

Standard Telephones and Cables Limited have a vacancy in their central Factory Design and Planning Department for an Electrical Engineer.

He will handle all matters relating to the design, planning, ordering, erection and installation of electrical net works and auxiliary equipment for the Company's factory buildings, offices and laboratories. The work includes high and low voltage supplies, design of sub-station layouts (h.t. and l.t.), power and lighting layouts and ancillary services such as telephones, fire alarm systems, etc.

The ideal candidate would have served an apprenticeship with an electrical contractor, spent some time in a D.O. on layout work, and had some years' experience of controlling site installation. Qualifications: A.M.I.E.E. or the equivalent desirable but not essential. The appointment is based on London — but a fair amount of travel — some abroad — would be involved.

We are looking for a capable man to whom we shall have to pay an above average salary.

A non-contributory pension scheme is in operation.

Send brief relevant details to Manpower Section,

Standard Telephones and Cables Limited
Connaught House, 63 ALDWYCH, LONDON, W.C.2
Quoting ref. ER/14

1795

SOUTH WALES ELECTRICITY BOARD

Assistant Chief Engineer (Meters)

APPLICATIONS are invited from Chartered Electrical Engineers with wide experience of all aspects of electrical metering for the position of ASSISTANT CHIEF ENGINEER (Meters).

The successful applicant will be responsible to the Chief Engineer for all matters in connection with energy metering and ancillary equipment. He will manage the new meter testing station now under construction at Cardiff, where the repair and testing of all metering and ancillary equipment used by the Board will be centralised. Responsibilities will also include the commissioning and maintenance on site of all polyphase power metering equipments, a number of which are associated with very large loads and operate at voltages up to 66 kV.

The salary will be in accordance with Class B, Grade 6 of the National Joint Managerial and Higher Executive Grades Committee, namely, £2,170-£2,380 per annum.

Applications should be sent to the undersigned at St. Mellons, Cardiff, to arrive not later than 15th August, 1961.

Please quote reference 93/61/ER, endorsing envelope "Assistant Chief Engineer (Meters)."

R. G. WILLIAMS,
Secretary.

1798

NORTH WESTERN ELECTRICITY BOARD

First Assistant District Engineer, Central District, Manchester

The duties will include assisting in the planning, construction, maintenance and operation of the L.V. and H.V. networks, including substations, records, control of transport, etc. Applicants should have had a wide general experience on the distribution side of electricity supply, and be prepared to undertake standby duties. Corporate Membership of the Institution of Electrical Engineers will be an advantage.

Salary scale £1,535/£1,720 p.a., Grade J.4. N.J.B. conditions.

Senior Assistant (Sales Superintendent), South District, Cheadle

Applicants should be experienced in the supervision of service centres, organisation of exhibitions, demonstrations and displays. The successful candidate will be responsible for domestic and commercial development, and the supervision of staff engaged on that work. Ability to develop business is essential, and preference will be given to applicants with technical qualifications.

Salary scale £1,150 × £30 to £1,240 p.a., Grade 6. N.J.C. conditions.

Applications on forms to be obtained from the Manager (Staff Vacancy), No. 1 Sub-Area, North Western Electricity Board, Town Hall, Manchester, 2, P.O. Box 493, and returned to him by 8th August, 1961.

1769

***Situations Vacant** (continued)*

THE CULHAM LABORATORY OF THE UNITED KINGDOM ATOMIC ENERGY AUTHORITY

requires an

ELECTRICAL ENGINEER OR PHYSICIST

for high-voltage research.

A new technology is being developed for fusion research. For example, high voltages having a wide range of waveforms must be withstood across small thicknesses of insulation, and research is in progress into the characteristics of dielectrics.

A vacancy exists with the team engaged on this research for an electrical engineer or physicist, preferably one with experience of high-voltage phenomena.

The post will be graded Scientific Officer or Senior Scientific Officer, according to the age and experience of the successful candidate, who should have a First or Second Class Honours Degree in Electrical Engineering or Physics. The salary scales for these grades are :—

SCIENTIFIC OFFICER:
£790 - £1,310 per annum.
SENIOR SCIENTIFIC OFFICER:
£1,440 - £1,770 per annum.

Housing and contributory superannuation scheme.

Send a POSTCARD for application form to the Senior Personnel Officer (CAP/40/29/48), Culham Laboratory, Culham, Abingdon, Berks.

1779

SOUTH OF SCOTLAND ELECTRICITY BOARD

Fife Area

Third Assistant Engineer

APPLICATIONS are invited for appointment as THIRD ASSISTANT ENGINEER in the Construction Section, Area Headquarters, East Port, Dunfermline.

Applicants should have a good experience of all types of overhead line construction up to and including 33 kV.

N.J.B. conditions and salary, Class J, Grade 10 (Scale 8), £1,040/£1,165 per annum; post superannuable, subject to satisfactory evidence of health.

Applications on the standard form, obtainable from the Area Manager, South of Scotland Electricity Board, East Port, Dunfermline, should be returned to him not later than Saturday, 12th August, 1961.

1813

TEST ENGINEER

for work on power transformers and allied equipment. His duties will include technical supervision of routine testing, impulse and noise, and other specialised testing and development work. He should already possess H.N.C. or be progressing to that level.

This position carries good prospects of advancement to Chief Tester of the company in a few years.

Apply Chief Engineer, Gresham Lion Group Limited, Twickenham Road, Hanworth, Middx.

1763

CENTRAL ELECTRICITY GENERATING BOARD

North Eastern Region

Regional Electrical Engineer's Department, Transmission Project Branch

Third Assistant Engineer (Drawing Office), Section Leader, Electrical

APPLICATIONS are invited from engineers who possess a Higher National Certificate and who have had a number of years' experience in a manufacturer's or other drawing office dealing with layouts and diagrams for H.V. grid substations for appointment as Section Leader (Electrical) in the Regional Electrical Department Drawing Office at Leeds.

The person appointed will be responsible for organising and leading a team of senior and engineering draughtsmen engaged on interesting and varied work connected with an extensive construction programme of reinforcement to the Transmission Grid System within the North Eastern Region. Previous applicants for this post need not re-apply.

The salary for this appointment will be in accordance with the National Joint Board Agreement, Schedule B, Grade 8BX, £1,145-£1,410 per annum) and will commence at a point commensurate with qualifications and experience.

Forms of application may be obtained from the Assistant Regional Secretary (Personnel), Central Electricity Generating Board. North Eastern Region, 1, Whitehall Road, Leeds, 1, to whom they should be returned to arrive not later than 9th August, 1961.

1770

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Region, North Thames Division

APPLICATIONS are invited for the following appointment :—

THIRD ASSISTANT ENGINEER,
DIVISIONAL ELECTRICAL DEPT.
(System Development Section),
DIVISIONAL HEADQUARTERS,
COCKFOSTERS (North London)
(S.V. No. 1456).

Salary N.J.B. Class AX, Grade 6, Scale 12, £1,285-£1,500 per annum, plus London weighting £50 per annum.

The successful applicant will be required to assist in the preparation of system reinforcement schemes entailing the technical and economic appraisal of schemes and the preparation of reports.

A knowledge of network analyser practice, symmetrical component analysis and of the design of high-voltage transmission systems would be an advantage. Applicants should have had a sound technical training and experience in this type of work and/or in the construction and operation of high-voltage systems. They should preferably have qualifications in electrical engineering equivalent to Corporate Membership of the Institution of Electrical Engineers.

Applications, quoting reference S.V. No. 1456, stating age, qualifications, experience and present position, should be sent to the Personnel Officer, Central Electricity Generating Board, South Eastern Region, North Thames Division, West Farm Place, Chalk Lane, Cockfosters, Barnet, Herts., by 5th August, 1961.

1802

ADMINISTRATIVE COUNTY OF LEICESTER

ASSISTANT ELECTRICAL ENGINEER, £960-£1,310. Candidates must be Associate Members of the Institution of Electrical Engineers or be in possession of the Higher National Certificate and be experienced in the design of electrical installations for all types of buildings.

Removal expenses and lodging allowance may be paid to a married man.

Apply on form available from the County Architect, 123, London Road, Leicester. 174

Eastern Electricity

Northmet Sub-Area

GENERAL ASSISTANT ENGINEER,
SUB-AREA CONSTRUCTION DEPT.
(Ref. 1077) (167/61R).

Candidates should have had a sound technical training and be experienced to assist in the supervision of direct or contract labour employed on laying and jointing of all classes of cable up to and including 33 kV.

Salary N.J.B. Class N, Grade 14, £1,090 - £1,215, inclusive of London allowance.

Apply by letter to the Manager, Northmet Sub-Area, Eastern Electricity Board, Northmet House, Southgate, London, N.14, by 11th August, 1961.

Suffolk Sub-Area

THIRD ASSISTANT ENGINEER
(Commercial),
SUB-AREA HEADQUARTERS
(170/61.R).

Candidates should have received a good general and technical education and training. They should have a sound knowledge of industrial electrical installations and the necessary experience to advise commercial and industrial consumers on the application and utilisation of electricity in their businesses, and be competent to assist in negotiating agreements for supplies of electricity to these consumers.

Possession of appropriate technical qualifications would be an advantage.

Salary N.J.B. Class K, Grade 10, £1,115 - £1,245.

Apply by letter to the Manager, Suffolk Sub-Area, Eastern Electricity Board, Finborough Hall, Stowmarket, by 11th August.

CLACTON DISTRICT

DEMONSTRATOR
(169/61.R).

Candidates should have had domestic science training, including electrical housecraft; should hold the E.A.W. Certificate, be competent to plan and give cookery demonstrations, including lectures, and help housewives to select, buy and use efficiently appliances most suited to their needs.

Salary N.J.C. Grade 1, £600-£700.

Apply by letter to S. N. Boyne, A.M.I.E.E., Manager, Clacton District, Eastern Electricity Board, 56/58, Station Road, Clacton-on-Sea, Essex, by 21st August, 1961.

1815

COVENTRY TECHNICAL COLLEGE

Principal: H. C. Smith, M.Sc., Ph.D., F.R.I.C.

Department of Electrical Engineering

APPLICATIONS invited for the post of ASSISTANT LECTURER GRADE B to teach ELECTRICAL INSTALLATION WORK. City and Guilds Full Technological Certificate desirable. Appropriate industrial and teaching experience essential. Duties to commence as soon as possible.

Salary scale (under review) £700-£1,150 per annum, plus additions depending on training and qualifications.

Further particulars and application forms (s.a.e. foolscap) from Principal, Coventry Technical College, Butts, Coventry, to be returned by 21st August.

W. L. CHINN,
Director of Education.

1818

SOUTH WALES ELECTRICITY BOARD

Assistant Engineer

APPLICATIONS are invited for the position of Assistant Engineer in the West Monmouthshire District (Bargoed) of the Monmouthshire and Mid-Wales Area.

Salary N.J.C. Class H, Grade 9, Scale 8 (£1,040/£1,165 per annum).

Preference will be given to engineers possessing the Higher National Certificate in Electrical Engineering.

Applications stating age, present position, present salary, qualifications and experience should be addressed to W. E. Richardson, M.I.E.E., Manager, Monmouthshire and Mid-Wales Area, Llywelyn Road, Cwmbran, Mon., so as to arrive not later than 15th August, 1961.

Please quote reference 94/61/ER, endorsing envelope "Assistant Engineer."

R. G. WILLIAMS,
Secretary.
1793

WORCESTERSHIRE EDUCATION COMMITTEE

College of Further Education, Bromsgrove Engineering Department

APPLICATIONS are invited from suitably qualified persons for the following full-time appointment, to start as soon as possible.

ASSISTANT, GRADE B to teach electrical engineering subjects in Electrical Trades and Mechanical Engineering courses; Principles of Electricity is offered as an endorsement subject in Mechanical Engineering courses.

Teaching experience, though an advantage is not essential. The salary will be in accordance with the Burnham Technical Scale:—£700 by £27 10s. (15) and £37 10s. to £1,150.

Application forms may be obtained from the County Education Officer (TS), County Education Office, Castle Street, Worcester, on receipt of a stamped addressed foolscap envelope. (P.216.)

1805

ELECTRICAL ENGINEER, NORTH BORNEO ELECTRICITY BOARD

APPLICATIONS are invited for the above post on contract for 1 tour of 3 years. Salary according to qualifications and experience in scale (including inducement allowance) rising to £2,534 a year. Gratuity at rate of 15% of basic salary drawn for each completed year of service. Free passages. Liberal leave on full salary.

Candidates, under 45 years of age and preferably Corporate Members of the I.E.E., must be able to supervise staff engaged in installation and maintenance of diesel generating plant, and capable of designing overhead and underground distribution schemes up to 33 kV. They should also be able to organise general office staff and departments dealing with tariffs and stores.

Apply to CROWN AGENTS, 4, Millbank, London, S.W.1, for application form and further particulars, stating age, name, brief details of qualifications and experience, and quoting reference M2A/51387/EF.

1782

ELECTRICAL MACHINE DESIGNER

required for manufacturers in S.W. Lancs. H.N. Certificate minimum. Should be familiar with detail design of all types of A.C. and D.C. machines and electro-magnetic equipment.

Progressive post with contributory superannuation scheme after qualifying period.

State age, qualifications, previous experience and salary required. All applications in strict confidence. — Box S.959, Lee & Nightingale, Liverpool, 2. 158

AN ATTRACTIVE VACANCY
for

ELECTRICAL DESIGN ENGINEER

in
AUSTRALIA

ELECTRICAL Design Engineer required as Assistant Design Engineer to the Chief Electrical Engineer of an Australian company situated in Melbourne who design and manufacture a large range of rotating electrical equipment. Experience in design of electric motors essential and good technical qualifications. Age not older than 35 years. Commencing salary £1,500 Australian. Prospects excellent to advance to Chief Electrical Engineer of the company in the future.

Applications in writing, giving details of training and experience, positions held, etc., to :—

The General Manager
THE ELECTRIC CONSTRUCTION COMPANY LIMITED
Bushbury Engineering Works
Wolverhampton 1762

TECHNICAL SALES REPRESENTATIVES

MAWDSLEY'S LIMITED
Dursley, Glos.

MAKERS of special-purpose rotating electrical machinery with wide and varied applications require technically qualified (Degree or H.N.C.) Sales Representatives in the West Midlands centred on Birmingham and in the London area.

Experience in design or manufacture of the company's type of product and related sales experience are essential qualifications.

Salaries will be negotiated. A pensions and life assurance scheme is in operation. Holiday arrangements for 1961 will be honoured in all respects.

Applications will be treated in ABSOLUTE CONFIDENCE and should be addressed to the Personnel Adviser, giving a full summary of career and training.

1701

SENIOR ELECTRICAL DRAUGHTSMAN

required by

KODAK LIMITED

to work in its Project and Design Department. This Department is a member of the Engineering Division where over 1,000 people are employed. Candidates should be experienced in the preparation of schemes and specifications for factory distribution systems. Qualifications up to H.N.C. or equivalent.

The company offers excellent employee benefits, including a profit sharing scheme, a voluntary part contributory life insurance plan and a pension scheme.

Please apply quoting JAW/7:
Men's Personnel Department
KODAK LIMITED (FACTORIES)
Harrow, Middlesex
1819

SOUTH OF SCOTLAND ELECTRICITY BOARD

Lanarkshire Area

Installation Engineer, Lanark District

APPLICATIONS are invited for the position of INSTALLATION ENGINEER from trained electricians capable of installing and testing all types of electrical installations and conversant with the Electricity Supply Regulations (1937) and the I.E.E. Regulations for the electrical equipment of buildings. Technical qualifications to Ordinary National Certificate or higher standard would be an advantage.

The salary and conditions of service for this appointment will be in accordance with the National Joint Board Agreement, Schedule A. The present classification and grading is E.9 (Scale 5); salary £825/£940 per annum. The post is superannuable.

Application forms, which can be obtained from the Area Manager, Montrose Crescent, Hamilton, should be returned to this office within 14 days from the appearance of this advertisement.

1806

SOUTH WESTERN ELECTRICITY BOARD

SECOND ASSISTANT DISTRICT ENGINEER (Planning), Exeter. Salary within Class G, Grade 7, Salary Scale 9 (£1,115 to £1,245 per annum) of the N.J.B. Agreement.

The successful candidate will be required to assist generally in the technical work of the engineering department and to undertake planning and preparation of system improvements and extensions schemes on underground and overhead mains and substations up to and including 33 kV. He may also be required to undertake standby duties.

Experience on distribution systems at voltages up to 33 kV is essential and the possession of technical qualifications leading to Corporate Membership of the Institution of Electrical Engineers is desirable. A current driving licence would be an advantage.

Applications for this post to be made on standard form AE6/ACT, OBTAINABLE BY POSTCARD ONLY from the District Manager, South Western Electricity Board, 3, Bedford Street, Exeter. Closing date for receipt of completed applications is 12th August, 1961.

1817

NORTH WEST METROPOLITAN REGIONAL HOSPITAL BOARD

CLERK OF WORKS (Engineering) required for supervision of site works in various establishments.

Applicants must have served an apprenticeship in mechanical or electrical engineering and have had not less than five years' experience supervising site installations. They must be capable of supervising both mechanical and electrical work.

Salary scale £800 × £40 (5) × £50 (1) to £1,050 plus £30-£50 London weighting. Superannuable, Whitley Council conditions.

Apply, stating age, qualifications and experience, with names and addresses of two referees (preferably employers), to Secretary, North West Metropolitan Regional Hospital Board, 40, Eastbourne Terrace, London, W.2, quoting reference 959, by 14th August.

1830

DEPARTMENTAL MANAGER

MANUFACTURERS of industrial electric motors with world-wide connections require the services of a MANAGER for a division employing upwards of 200 male and female employees in high-volume production.

Applications are invited from men having the necessary production experience interested in modern methods and an expanding programme. Please state, in confidence, experience to date and salary expected to—Box 1706.

***Situations Vacant** (continued)*

LONDON ELECTRICITY BOARD

General Assistant Engineers

APPLICATIONS are invited for the above positions. Initially the successful candidates will be located at 84, Romford Road, Stratford, London, E.15.

Applicants should have a sound technical education to the standard of the Higher National Certificate, and have completed a recognised period of training in the electricity industry, or have equivalent experience.

The posts are graded under Schedule B of the National Joint Board Agreement as Class BX, Grade 15, £725 to £920 per annum, inclusive of London allowance.

Applications, stating age, qualifications and experience should be sent direct to the Manager at the above address, within ten days of the publication date of this notice. Please quote ref. PER/V/3110/R.

1808

BOROUGH OF CREWE

Borough Engineer's Department

Appointment of Electrical and Street Lighting Superintendent

APPLICATIONS are invited from suitably qualified persons for the position of ELECTRICAL AND STREET LIGHTING SUPERINTENDENT. Salary Grade III, £960 to £1,140 per annum.

The person appointed will be required to take full control of the Electrical and Street Lighting section of the department, and be responsible for the preparation of electrical designs, specifications, estimates, etc., and the supervision of works carried out by direct labour or contract.

Applications on forms to be obtained from the Borough Engineer, Municipal Buildings, Crewe, returnable not later than Thursday, 3rd August, 1961.

A. BROOK,
Town Clerk. 1702

WHIPP & BOURNE LTD.

of Castleton, Near Rochdale

have a few vacancies in permanent pensionable positions for

DRAUGHTSMEN

Applicants should have a minimum qualification of O.N.C. and have good experience in A.C. and D.C. marine and industrial switchgear.

The factory is on the main A664 road between Manchester and Rochdale and there are excellent diesel and bus services between Castleton and surrounding towns including Manchester. There are possibilities of promotion in the future after experience with the company.

Applicants should give brief details of age, qualification and experience. They should be sent in writing to the Chief Draughtsman, Whipp & Bourne Ltd., Castleton, Rochdale, Lancs.

1822

NORTH WESTERN ELECTRICITY BOARD

Fourth Assistant District Engineer
Oldham District

DUTIES include assisting with the operation, maintenance and construction of the distribution system, both underground and overhead up to 33 kV, including substations; standby duty. Applicants should preferably be suitably qualified.

Salary scale £890/£1,015 p.a. Grade H.11. N.J.B. conditions.

Applications on forms to be obtained from the Manager, No. 3 Sub-Area, North Western Electricity Board, Union Street, Oldham, and returned to him by 14th August, 1961.

1804

CHIEF ELECTRICIAN

required for

SPILLERS MILLS, CARDIFF

CANDIDATE must possess National Certificate in Electrical Engineering, knowledge of electronic techniques, H.T. and L.T. switchgear, A.C. distribution systems and plant.

Salary commensurate with experience.

Applications to Mill Manager, Spillers Limited, Roath Dock, Cardiff.

1768

TECHNICIAN

MINISTRY OF AVIATION, Kirkby, near Liverpool, requires TECHNICIAN to supervise the approved inspection organisations at firms producing electrical power and telegraph equipment.

Quals.: Recognised eng. apprenticeship or equiv. training. O.N.C., C. & G. Final Certs. or equiv. Experience in the inspection and testing of the equipment described above and experience of control of staff.

SALARY £988-£1,128. Good prospects for promotion and pension. Technical college courses sponsored for suitable candidates.

Application forms from Manager (PE.2448), Ministry of Labour, Professional and Executive Register, Atlantic House, Farringdon Street, London, E.C.4. 1758

OTTERMILL SWITCHGEAR

invite applications from draughtsmen wishing to work in their medium-voltage switchgear drawing office. Bonus and non - contributory superannuation schemes in operation.

The company is within six miles of the South Devon coast, and houses will be available for the selected applicants.

Applications stating age and previous experience should be addressed to Ottermill Switchgear Ltd., Ottery St. Mary, Devon. 1719

JUNIOR DRAUGHTSMAN

preferably with experience of electrical installations, required for electrical department of a large firm of building contractors and engineers situated in London, to prepare schemes and final drawings.

Applications, with full details of experience and stating age and salary required, should be sent to—Box 1821.

OVERHEAD TRANSMISSION LINE ENGINEERS

LARGE contracting organisation has vacancies in Scotland for SITE AGENTS, SUB-AGENTS and ENGINEERS of proved ability with experience of steel tower overhead line construction. Age and full details of experience, which will be treated in confidence, to Box 632, Keith & Co., 137, Princes Street, Edinburgh. 1792

DUBLIN CONSULTING ENGINEERS

require SENIOR ELECTRICAL ENGINEERS and ASSISTANT ELECTRICAL ENGINEERS for interesting long-term work in electrical services in various kinds of buildings, including new university, hospital and theatre projects in Ireland.

Apply with full details of training and experience to :—

Box 2249
Easons Advertising Service, Dublin
1761

NORTH EASTERN ELECTRICITY BOARD

APPLICATIONS are invited from suitably qualified engineers for the appointment of THIRD ASSISTANT ENGINEER, Chief Engineer's Department, Planning and Development Section, at the Board's Headquarters, Carliol House, Newcastle upon Tyne. The duties will be to prepare schemes with technical reports for h.v. system extensions up to 66 kV. Experience of the layout of m.v. networks, short circuit calculations and load flow studies will be an advantage.

Salary Schedule B, Class BX, Grade 7, £1,235/£1,500 per annum. N.J.B. conditions of service.

Applications stating age, qualifications and experience to be received by Assistant Secretary (Establishments), North Eastern Electricity Board, G.P.O. Box No. 117, Carliol House, Newcastle upon Tyne, 1, not later than 11th August, 1961.

1811

CENTRAL ELECTRICITY GENERATING BOARD

South Wales Division

Vacancy No. 239/ER/61

APPLICATIONS are invited for the superannuable N.J.B. appointment of ASSISTANT SHIFT CHARGE ENGINEER, Uskmouth "A" Power Station, West Nash, near Newport, Mon.

Salary Schedule A, Class K, Grade 8, Scale 11, £1,275-£1,410 per annum, plus 10% shift allowance.

Applicants should possess H.N.C. or equivalent qualifications and have had operating experience in a modern power station.

Special application forms obtainable from Divisional Secretary, Central Electricity Generating Board, South Wales Division, Twyn-y-fedwen Road, Gabalfa, Cardiff, to be returned by 12th August, 1961.

1816

AN experienced cable jointer urgently required by electrical contractors. Ability to assist in cable contract and cable laying an advantage. Apply in confidence with details of experience to—Box 8303.

ARMATURE winder required with experience of machines up to 100 h.p. Ideal opportunity for young skilled man to establish a permanent position and gain further experience. Apply in writing, giving age, experience and present wages to the Works Employment Officer, Fuller Electric Ltd., Fulbourne Road, Walthamstow, London, E.17. 1826

ASSISTANT, age 25-35, required for electric tool sales division of engineering company in Fulham area. Good educational standard essential and some technical knowledge preferable. Apply stating age, experience and salary expected to—Box 1772.

ASSISTANT electrical engineers with at least H.N.C. and 2/3 years' experience of E.H.V. transmission work required by consulting engineers in their contracts and design department, Weybridge. Applications stating age, qualifications, experience and salary required to — Kennedy & Donkin, 12, Caxton St., London, S.W.1, quoting ref. RWMc. 177

BRITISH ENGINE BOILER & ELECTRICAL INSURANCE Co. Ltd., Longridge House, Manchester, 4. Electrical surveyor required. Permanent position carrying progressive salary scale £825 to £1,225 with non-contributory pension. Candidates aged 26 to 32, with H.N.C. in electrical engineering or Grad. I.E.E. and with apprenticeship in manufacture or repair of electrical machinery, are invited to apply stating age, qualifications and experience. 1825

COST accounts clerk. Must be thoroughly conversant with interim valuations and preparation of final accounts particular to electrical contracting. This is a senior appointment carrying a good salary. Pension and housing facilities available. Apply with full details to—J. W. Russell Ltd., The Electrical House, 18, Queens Road, Watford. 1765

CONTRACTORS, senior and assistant engineers required by well-established firm, central London, for quality work of all types. Positions offer scope for advancement for capable and energetic engineers. Write fullest detail, in confidence, of experience, training, age and salary required.—Box 133.

DESIGN officer (electrical) required for the estimating, design, detailing and specification of electrical services including site distribution, power, lighting and motor control systems for chemical/industrial plant, laboratories, etc. An Ordinary National Certificate in electrical engineering is essential and a Higher National Certificate desirable. Experience in electrical design associated with chemical plant is also desirable.—Personnel (Technical), I.C.I. Limited, Wexham Road, Slough, Bucks. 1824

ELECTRICAL contracting and estimating engineer (assistant), progressive position.—T. A. Boxall & Co. Ltd., 20, Balcombe Road, Horley, Surrey (Tel. Horley 4388/9). 1773

ELECTRICAL engineer-surveyor required by an insurance company for appointment as inspecting engineer, Southampton area. Qualifications winding shop experience and technical education to H.N.C. standard. Salary £825-£1,225 per annum (progressive). Pension scheme. Car supplied. Apply—Chief Engineer, Cornhill Insurance Co. Ltd., P.O. Box 10, 57, Ladymead, Guildford, Surrey. 1693

ELECTRICAL supervisor required for a large industrial undertaking in Nigeria. Applicants must be mature men with good experience of preventive maintenance as well as electrical installation work. Age limit 50 years. The successful candidate will be offered a service contract of about 24 months, after which future contracts may be negotiated. Salary with overseas allowance not less than £2,000 per annum or according to experience. In addition a gratuity will be paid at satisfactory completion of contract. Overseas service terms include furnished accommodation at reasonable rent, free medical attention and free passages. Apply to—Box 1791.

ELECTRICIANS. We have a vacancy in the South of England for an electrician, preferably a foreman or chargehand, to supervise and inspect house wiring schemes. Must be willing to travel; vehicle provided. Staff appointment, good salary and prospects. Pension scheme.—Box 1828.

ESTABLISHED electrical engineering concern engaged in manufacture and repair of electric motors and transformers require qualified electrical engineers for staff appointments in United Kingdom. Age limit 37. Good conditions. Applications stating training, qualifications, experience, present position to—Box 1774.

ESTIMATING and supervising engineer, assistant and senior, required for electrical contractor's office near London Bridge. Applicants should have experience of all branches of contracting industry, embracing design to final invoice. Write stating age, experience and salary required to—Phœnix Electrical Co., 16-18, Marshalsea Road, London, S.E.1. 1829

FOREMEN urgently required by electrical contractors, preferably with steelworks experience, for new installation work in South Wales. Apply in confidence with details of experience to—Box 8304.

H.T. and L.T. cable jointers required for work in Southern England.—Box 8300.

INTERESTING opportunity for young engineer to work on development of rectifier control circuits and similar problems. Some relevant experience required, including a knowledge of transistors and transductors. H.N.C. standard desirable. Age 20-26. Apply giving details of training and experience to—P. G. Davies, Hackbridge and Hewittic Electric Co. Ltd., Walton-on-Thames, Surrey. 1775

JUNIOR draughtsmen for outdoor contracts department. Minimum requirement O.N.C. Young men whose interest lies in the field of supply and installation of electrical gear, underground cables and overhead lines. Applications stating age and experience to—Employment Manager, Johnson & Phillips Limited, Victoria Way, Charlton, London, S.E.7. 1637

MEDWAY WATER BOARD require a technical assistant (electrical) for duties in the supply department. O.N.C. in electrical engineering and drawing office experience essential. Some knowledge of mechanical engineering an advantage. Salary range £645 to £815 p.a. Local Government conditions of service and superannuation scheme apply. Write—Engineer and Manager, 25, Railway Street, Chatham, giving age and experience. 1823

LEADING designer-draughtsman, experienced in the manufacture of switchboards, control boards, etc., required for South Coast firm. Good salary, conditions and prospects. Write—Box 1766.

METER testers required with experience of polyphase and/or single-phase house service electricity meters. Applicants with electrical or mechanical O.N.C. will receive special consideration in an expanding organisation. Apply—Chief Meter Engineer, Denis Ferranti Meters Ltd., Bangor, North Wales. 1652

REPRESENTATIVE required by the Wandsworth Elec. Mfg. Co. Ltd. for West Midlands and South Wales area. Preferably based Birmingham. Electrical experience and connections with consulting engineers and public authorities desirable. Under 40 years old. Car provided. Pension scheme. Apply—Sales Manager, Wandsworth Elec. Mfg. Co. Ltd., 7/9, Baker Street, London, W.1. 1748

SALES engineer/representative required by London electrical manufacturers' agent. H.N.C. Some technical sales experience an advantage but not essential. State age, experience and salary required.—Box 8305.

SALES engineer. Siemens-Schuckert (Great Britain) Ltd., Great West Road, Brentford, Middx. have a vacancy in their switchgear sales dept. for an assistant electrical engineer. Applicants should have had good engineering training and be able to deal with enquiries and orders for electrical control gear and associated equipment. A knowledge of German is an advantage but not essential. Pension and bonus schemes in operation. Write fully, marked "Confidential," to—Sales Manager, "V" Department. 1831

SANGAMO WESTON Limited require a representative for London and South Eastern area. Aged 25/35 years. Electrical background. Salary according to experience. Applications should be made to the Personnel Manager, Sangamo Weston Limited, Cambridge Road, Enfield, Middlesex. 1698

SENIOR and junior electrical engineers required for London consulting engineers' office for installation design of industrial, commercial and educational buildings. Apply stating age, experience, training and salary required to Box 1783, or 'phone Welbeck 3564.

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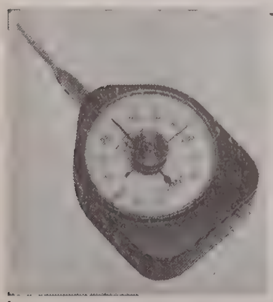

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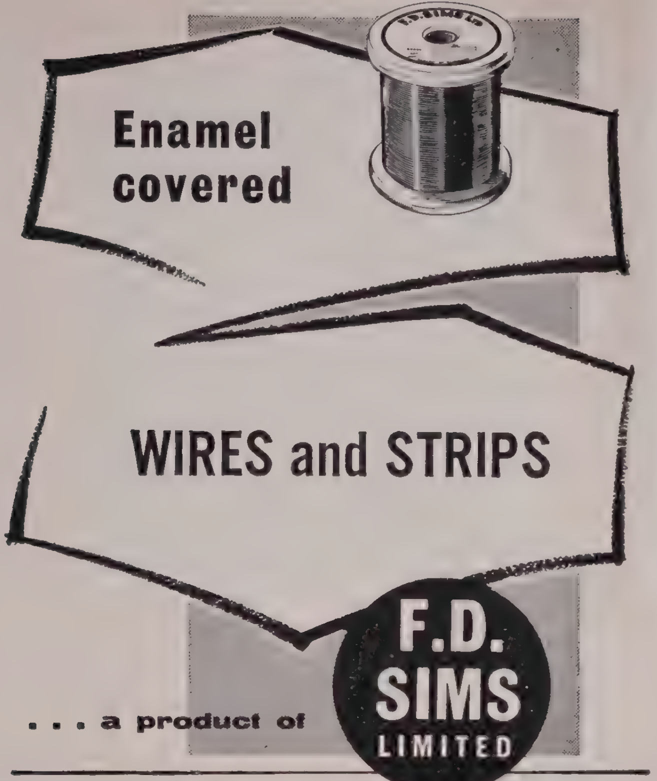
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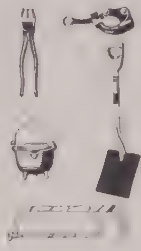
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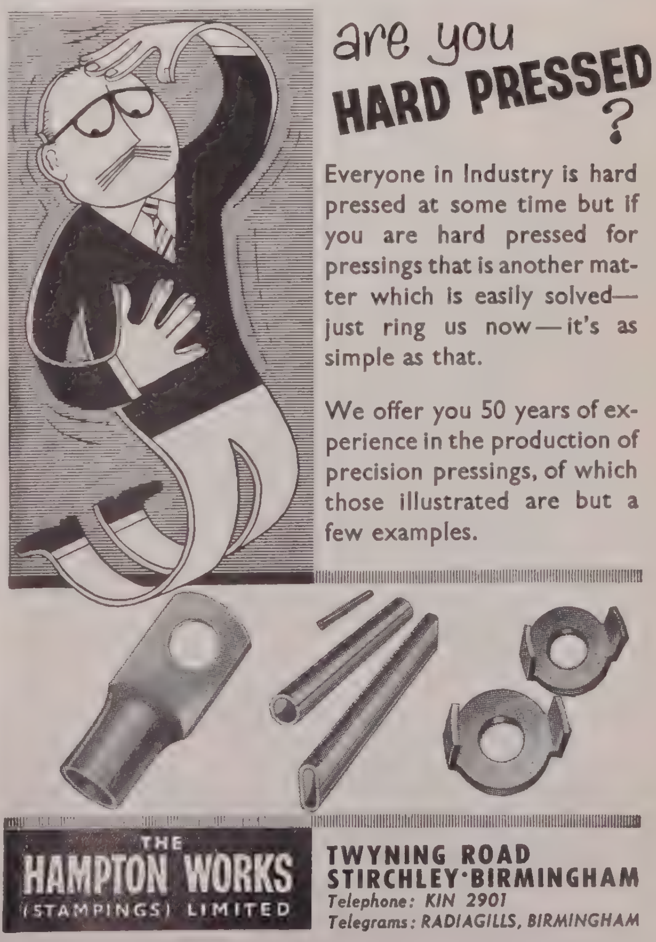
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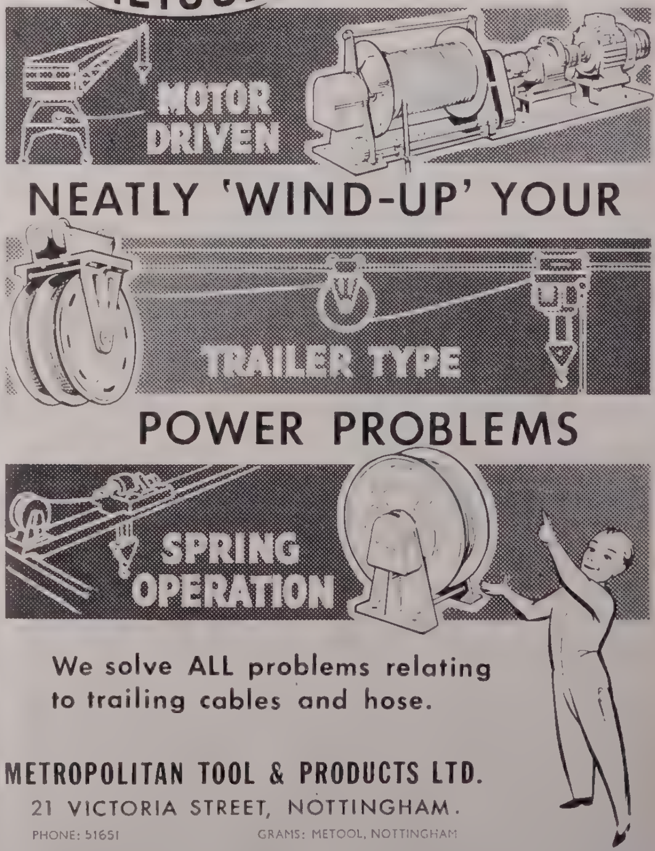

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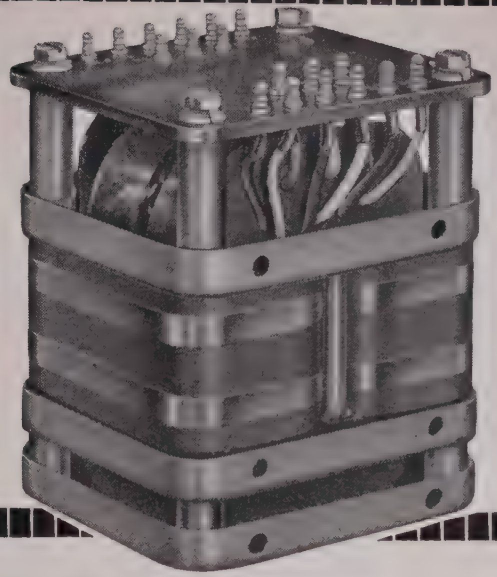

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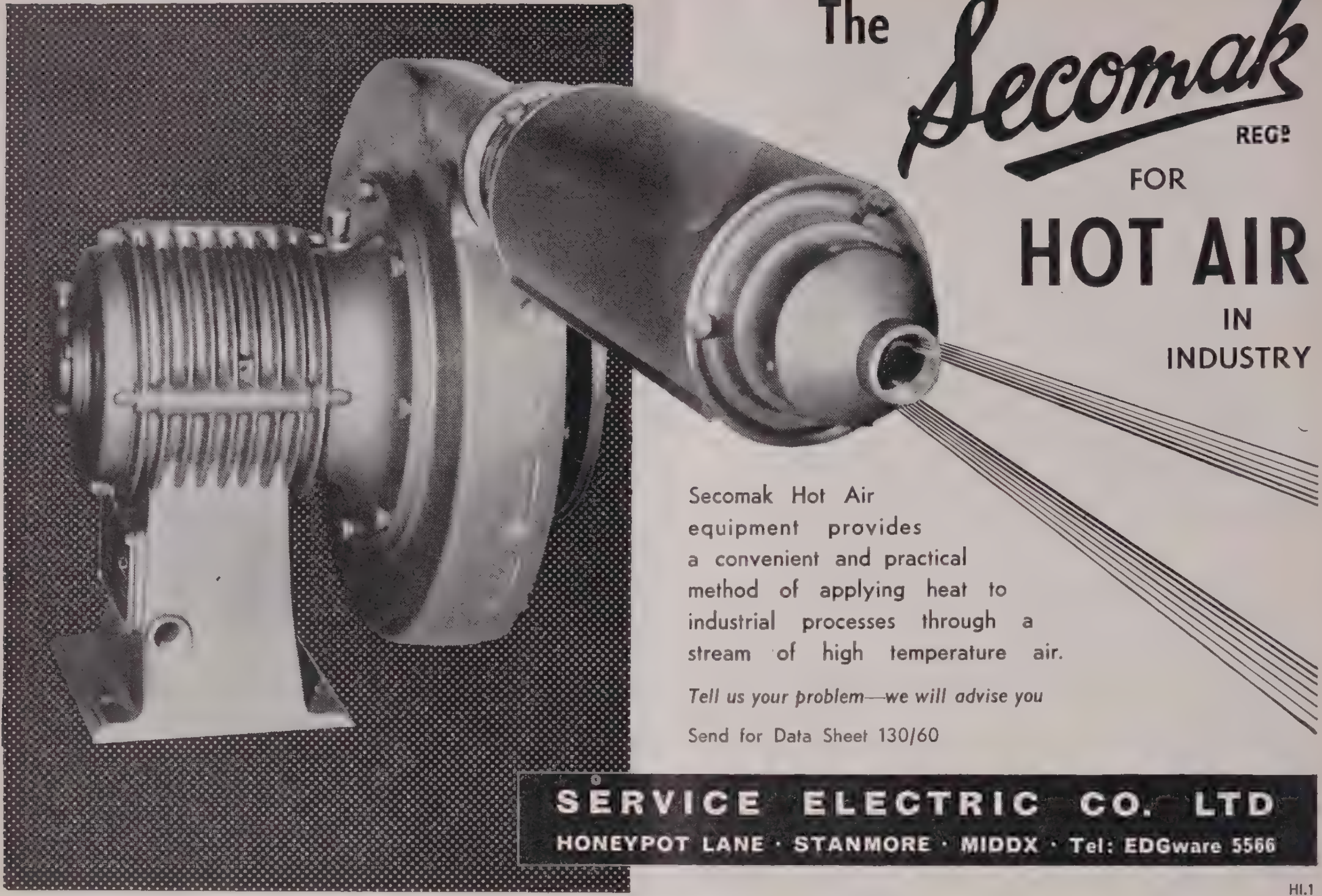

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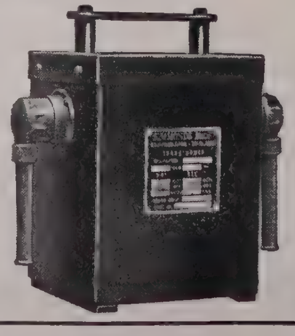

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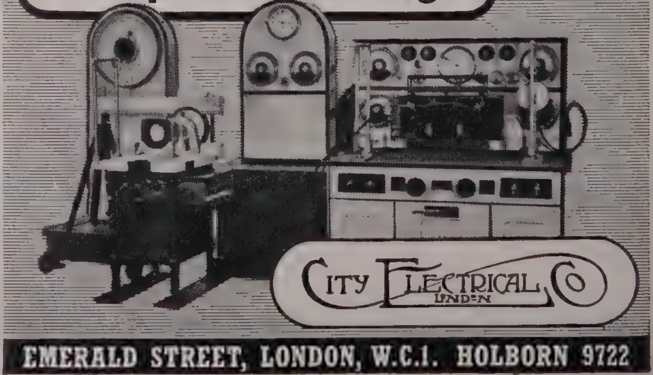

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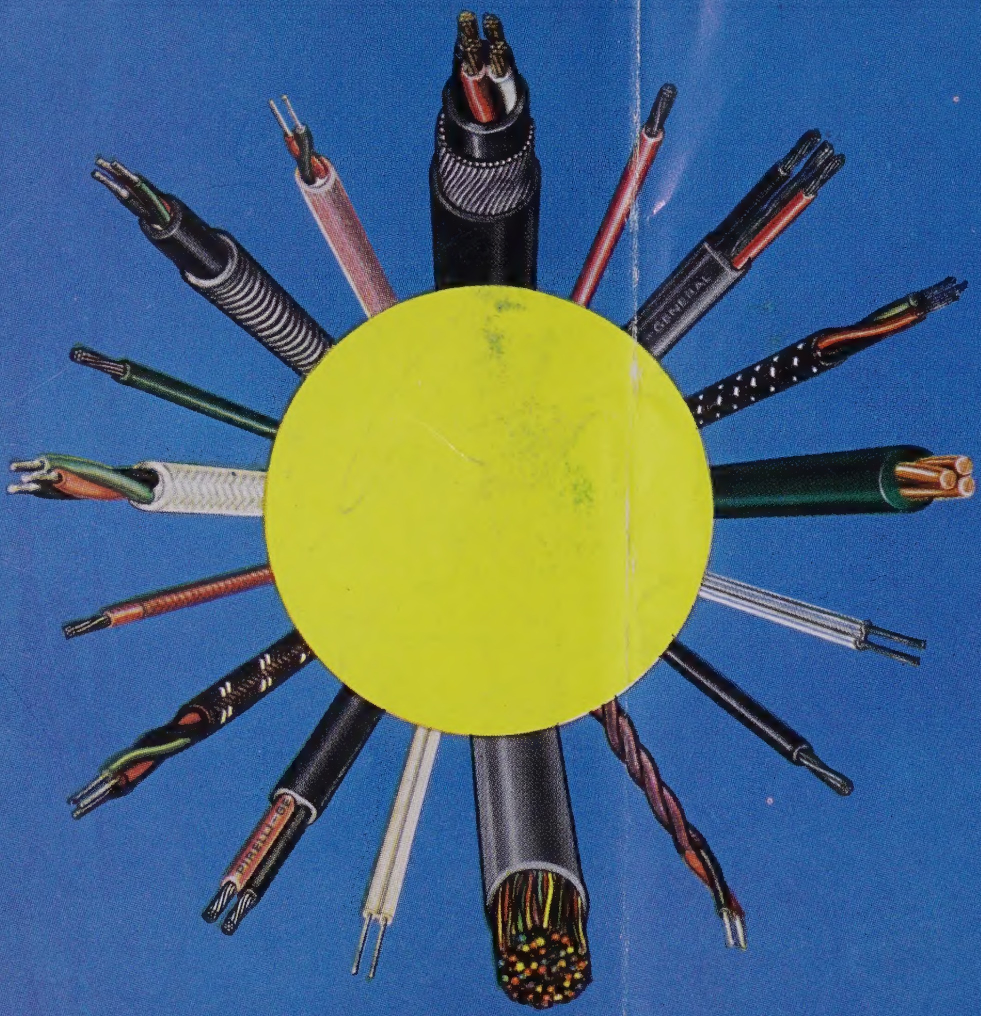

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